FAA-STD-032 REPRO
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U.S. Department of Transportation

Federal Aviation Administration

Standard

DESIGN STANDARDS

FOR NATIONAL AIRSPACE SYSTEM PHYSICAL FACILITIES

Contents

List of Tables

1. SCOPE

1.1 Scope. This standard defines the design requirements that shall be incorporated into designs of new National Airspace System (NAS) physical facilities and modifications to existing NAS physical facilities.

1.2 Purpose. This standard provides guidelines for the design of all new physical facilities and modernization and expansion of existing NAS physical facilities including buildings, structures, support equipment, surrounding grounds, and site utilities. Specific technical requirements for these facilities will be defined in the subsystem or project specification and in the facility development specification for each subsystem or project. This standard is primarily for use in the development of national standard designs and may be used for site adaptation by Federal Aviation Administration (FAA) Washington and FAA Regional Offices in the development of engineering requirements and task orders. This standard is to be used by FAA Washington in preparation of the physical facilities requirements portions of the NAS project specifications and shall be used by architects and engineers in the design of new physical facilities and modifications of existing NAS physical facilities.

2. APPLICABLE DOCUMENTS

2.1 Government documents. The following documents of the issue in effect on date of invitation for bids or request for proposal, form a part of this standard to the extent specified herein. In the event of conflict between the documents referenced herein and the contents of this standard, the contents of this standard shall be considered a superseding requirement.

SPECIFICATIONS:

FAA

FAA-E-113	Poles, Wood, Treated
FAA-C-1217	Electrical Work, Interior
FAA-C-1244	Installation of Engine Generators and Fuel Tanks
FAA-C-1391	Installation and Splicing of Underground Cable
FAA-E-2013	Cable, Electrical, Power, Exterior, 600 to 15,000 V
FAA-E-2042	Cable, Electrical Control, Exterior
FAA-E-2065	Fences
FAA-E-2072	Cable, Telephone, Exterior
FAA-G-2100	Electronic Equipment, General Requirements
FAA-E-2171	Cable, Coaxial, Armored, M17/6 - RG11
FAA-C-2256	Temperature and Humidity Control Equipment
FAA-D-2494	Technical Instruction Book Manuscript: Electronic, Electrical, and Mechanical Equipment, Requirements for Preparation of Manuscript and Production of Books
FAA-E-2619	Cable, Coaxial, RG-35 B/U

STANDARDS:

FAA

FAA-STD-002	Facilities Engineering Drawing Preparation
FAA-STD-005	Preparation of Specification Documents
FAA-STD-019	Lightning Protection, Grounding, Bonding and Shielding Requirements for Facilities
FAA-STD-033	Design Standards for Energy Management in NAS Physical Facilities

OTHER PUBLICATIONS:

FAA Orders

1050.1	Policies and Procedures for Considering Environmental Impacts
1050.10	Prevention, Control, and Abatement of Environmental Pollution at FAA Facilities
1365.1	Department of Transportation Graphic Standards
1600.6B	Protection of Agency Property
1600.54	Security of FAA Automatic Data Processing Systems and Facilities
1800.2	Airway Facilities Service Life Cycle Cost Studies
3900.19	Occupational Safety and Health
4660.1	Real Property Handbook
4660.2	Accessibility of FAA Buildings to the Physically Handicapped
5050.4	Airport Environmental Handbook
6000.13	Potentially Adverse Effects of Construction on Air Traffic Control and Air Navigation (ATC&N) Facilities
6030.20	Electrical Power Policy
6480.7	Airport Traffic Control Tower and Terminal Radar Approach Control Facility Design
6950.2	Electric Power Policy Implementation at National Airspace System Facilities
6950.15	ARTCC Critical Load Circuits and Configuration
6950.23	Cable Loop Systems at Airport Facilities
6960.1	Sanitary Systems in FAA Facilities
6980.24	Battery Theory and Selection Guidelines
6980.26	Battery Backup Power Systems - Theory and Selection Guidelines

FAA Management Documents

NAS-MD-790	Maintenance Processor Subsystem to Remote Monitoring Subsystems and Remote Monitoring Subsystem Concentrators Interface Control Document
NAS-MD-793	Detailed RMS Functional Definitions

Department of the Air Force Manuals

AFM 88-3	Seismic Design for Buildings, Chapter 13
AFM 88-29	Engineering Weather Data

Other Documents

Environmental Protection Agency (EPA)

National Environmental Policy Act

FAA Advisory Circulars

AC 70/7460-1	Obstruction Marking and Lighting
AC 150/5370-2	Operational Safety on Airports During Construction

Federal Register

41 CFR 101-19	Construction and Alteration of Public Buildings: Appendix A to Subpart 101-19.6, Uniform Federal Accessibility Standards

Occupational Safety and Health Administration

Requirements and Standards

Office of Management and Budget

Circular A-94	Discount Rates to be Used in Evaluating Time-Distributed Costs and Benefits

Copies of specifications, standards drawings, and publications required by suppliers in connection with specified procurement functions should be obtained from the procuring activity or as directed by the FAA Program Manager.

2.2 Non-government documents. The following documents of the issue in effect on date of invitation for bids or request for proposal, form a part of this standard to the extent specified herein. In the event of conflict between the documents referenced herein and the contents of this standard, the contents of this standard shall be considered a superseding requirement.

STANDARDS AND CODES:

American Association of State Highway and Transportation Officials (AASHTO)

American Conference of Governmental Industrial Hygienists (ACGIH)

Manual on Industrial Ventilation

American Institute of Steel Construction (AISC)

Code of Standard Practice for Steel Buildings and Bridges

American National Standards Institute (ANSI)

A17.1	Safety Code for Elevators and Escalators
C2	National Electrical Safety Code

American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE)

ASHRAE Handbook	Applications Volume
ASHRAE Handbook	Equipment Volume
ASHRAE Handbook	Fundamentals Volume
ASHRAE Handbook	Systems Volume
52	Methods of Testing Air Cleaning Devices Used in General Ventilation for Removing Particulate Matter

American Welding Society (AWS)

Architectural Aluminum Manufacturer's Association (AAMA)

Building Officials and Code Administrators International, Inc. (BOCA)

The BOCA Basic/National Building Code
The BOCA Basic/National Fire Prevention Code
The BOCA Basic/National Mechanical Code
The BOCA Basic/National Plumbing Code

Illuminating Engineering Society (IES)

Lighting Handbook, Reference and Application Volumes

Institute of Electrical and Electronics Engineers (IEEE)

International Association of Plumbing and Mechanical Officials (IAPMO)

Uniform Plumbing Code (UPC)

International Conference of Building Officials

Uniform Building Code (UBC)
Uniform Building Code Standards (UBCS)
Uniform Fire Code
Uniform Mechanical Code (UMC)

National Association of Plumbing - Heating - Cooling Contractors

National Standard Plumbing Code

National Electrical Manufacturers Association (NEMA)

National Fire Protection Association (NFPA)

Fire Protection Handbook
National Fire Codes (NFC)
National Electrical Code (NEC)

National Forest Products Association

National Design Specifications for Stress Grade Lumber and Its Fastenings

Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)

Architectural Sheet Metal Manual

Southern Building Code Congress International, Inc. (SBCCI)

Standard Building Code
Standard Mechanical Code
Standard Plumbing Code

Underwriters Laboratory, Inc. (UL)

Technical society and technical association specifications and standards are generally available for reference from libraries. They are also distributed among technical groups and using Federal agencies.

3. REQUIREMENTS

3.1 General. Except when otherwise stated herein and in addition to specifically cited codes and regulations, all designs shall be in accordance with the nationally recognized codes and regulations for greater uniformity of design and construction. National standard designs shall be in conformance with the Uniform Building Code, Uniform Fire Code, Uniform Mechanical Code, and Uniform Plumbing Code. In those instances where local codes or regulations are more stringent than, or are in conflict with nationally recognized codes and regulations, those local codes or regulations shall be used. The requirements (as defined 6.2.2) of this standard are not necessarily imposed on the designs of all physical facilities (as defined 6.2.2). The applicability of this standard is defined in the engineering requirement, task order or system specification. Design goals shall provide flexibility to accommodate expected variations in system configurations as individual FAA mission equipment (as defined in 6.2.2) is installed, modified, removed, or expanded during the NAS upgrade process. Design of buildings or space therein for housing of air traffic control, navigation, communication and radar facilities and their supporting elements are usually National Standard Designs contained in drawings, specifications, and directives prepared and distributed by Program Engineering and Maintenance Service. Technical space design is governed primarily by the amount, type, and configuration of FAA mission equipment to be installed, the protection and security of this equipment, the number and type of operating positions, and the related maintenance, administrative, training, general office and storage activities. Other factors such as economy of construction using value engineering concepts, duration requirements, equipment investment by the Government, environmental conditions, and aesthetic requirements shall also be considered.

3.1.1 Deviation from design standards. Regions may change or adapt nationally prescribed space design standards when necessary to meet specific site requirements. The changes shall be minimum and limited to conforming to building regulations and codes and other local factors. Local building materials (brick, metal panels, concrete block, etc.) may be substituted for the material specified in the standards when such substitutions are economically and technically justified for specific areas.

3.1.2 Environmental considerations. All FAA projects shall comply with the National Environmental Policy Act. Environmental considerations shall be in accordance with FAA Order 5050.4.

3.1.2.1 Environmental impact. Except for exempted facilities and categorical exclusions the beneficial and adverse environmental effects of the construction and operation of facilities shall be evaluated at the earliest practical stage in the design of FAA facilities. Exempted

facilities and categorical exclusions will be determined by the FAA on a case-by-case basis in accordance with FAA Order 1050.1 and 5050.4. All considerations of environmental impact shall be in accordance with FAA Orders 1050.1 and 5050.4.

3.1.2.2 Prevention, control and abatement of environmental pollution. Prevention, control, and abatement of environmental pollution at FAA facilities shall be in accordance with FAA Orders 1050.10 and 4660.1.

3.1.3 Energy conservation and management. NAS Plan projects involving energy consumption shall conform to FAA-STD-033.

3.1.4 Construction scheduling. When the size or complexity of the design warrants, the specification shall include the requirement that a Critical Path Method (CPM) network schedule analysis be prepared for each project. The CPM shall show the order in which a construction contractor could reasonably be expected to accomplish the construction work within the allotted time period, including procurement of materials, availability of support equipment (as defined 6.2.2), plant or facilities and specific requirement dates for delivery of Government furnished equipment. Schedules shall provide a plan for staging construction and equipment installation to avoid interference with assigned NAS operations and conform to FAA Order 6000.13.

3.1.4.1 Constructibility. A construction period of optimum duration shall be determined for each assigned project. All facilities shall be designed to ensure constructibility with minimum operational disruption. All construction constraints shall be evaluated. Items to be evaluated include climatic conditions, existing construction, materials availability, utility services or the need for temporary utility services and other unique site conditions affecting construction.

3.1.4.2 Continuity of operation. All site investigations and construction activities shall be planned to minimize any disruptions to air traffic control operations; safety and efficiency of the Air Traffic Control (ATC) System shall in no way be jeopardized. Any necessary disruptions shall be planned and coordinated with Air Traffic Service and accomplished during periods of low or no air traffic activity. ATC continuity, safety and efficiency shall be given prime consideration throughout all phases of design and construction.

3.1.4.3 Construction noise levels. Construction noise levels in the vicinity of ground/air and air/ground communications and residential areas shall be controlled and reduced and shall be in accordance with FAA Order 1050.1 Where local noise regulations and ordinances applicable to the specific physical facility location are more stringent than FAA Order 1050.1, the noise level in those areas shall conform to the local noise regulations and ordinances.

3.1.4.3.1 Noise control. Prior to commencing any physical facility construction activity in the vicinity of the air traffic control communication operations, suitable measures shall be taken to ensure that the construction activity noise level magnitude will not constitute a hazard to flight safety. Noises resulting from construction activities in the proximity of communications operating positions shall be controlled or suitably dampered to ensure that noises are not transmitted and do not interfere with other transmission or reception and that excessive noise is not a nuisance to the surrounding community.

3.1.4.3.2 Standards. Due to the diverse types of construction noise and the variables in air/ground or ground/air communications environments and operations, the solutions to the noise problems shall be determined on an individual basis. To aid in the solution of these problems, the following guidance shall be applied as appropriate to meet the requirements of this standard.

a. Schedule construction operations at periods of low or non-existing air traffic activity.

b. Isolate construction areas with acoustical drapes or curtains, or with temporary acoustical walls, ceilings, and floors as required to reduce sound transmission to acceptable levels.

c. Limit construction operations in air/ground communication areas to the installation function only. Perform fabrication, assembly (as defined 6.2.2), etc., functions elsewhere.

d. Utilize construction methods that result in minimum noise levels.

Where these methods do not provide sufficient acoustical isolation, coordinate with FAA Operations to utilize noise canceling microphones and headsets and "muff-type" earphones or use alternate operating positions located away from the construction area if they are available.

3.1.4.4 Construction safety on airports. All construction on airports shall comply with safety provisions as identified in Advisory Circular 150/5370-2. Each bidding document shall incorporate a section on safety on airports which, as a minimum, shall contain the provisions as outlined in Appendix 1 of FAA AC 150/5370-2. A safety plan shall be developed for approval by the airport operators and users for any necessary deviations from the criteria. On Federal Aviation Regulation Part 139, Certificated Airports, the safety inspector shall be involved in all stages of construction activity planning.

3.1.5 Construction contract specifications. Construction contract specifications shall be prepared in accordance with FAA-STD-005.

3.1.6 Construction contract drawings. Construction contract drawings shall be prepared in accordance with FAA-STD-002.

3.1.7 Cost estimating. Construction cost estimates shall be prepared for all NAS facilities. Estimates shall be provided during the various stages of design, shall be of sufficient detail to accomplish the intended purpose, and shall be expressed in physical units of measure and applicable unit costs. Additive items shall be shown as special features. All critical cost determining assumptions shall be stated.

3.1.7.1 Engineering cost estimate. Estimates shall be prepared on standardized estimating forms approved by FAA. Standard estimates shall be prepared for both national standard and site specific designs. Estimates for site specific designs shall be based upon the national standard design estimate to the greatest possible extent. Quantity takeoff work sheets shall be prepared to readily identify location of items, allow easy modification and assist in construction contract negotiations and change orders.

3.1.7.2 Design implementation cost control. Continuing construction cost analyses of the design shall be maintained during all phases of the design program. Construction cost analysis shall include approved escalation cost factors. An approved National Standard Cost Index shall be appropriately used in preparation of construction project cost estimates. Should any analysis indicate that the stipulated cost for any given specific project is being exceeded as a result of adhering to the design requirements specified herein, suitable design alternatives shall be proposed to meet these requirements. Where specified, a cost control reporting procedure shall be established in order to provide FAA management with timely cost trends. The procedure shall provide FAA management with the following:

a. Estimated total cost of project;

b. Monthly updating as design program matures;

c. Revised program cost projections due to changed requirements or cost savings programs.

3.1.8 Reliability, maintainability and availability. The intent of the FAA is to procure equipment for NAS facilities that provides the highest obtainable reliability consistent with life cycle cost evaluations. The procured equipment, systems, and subsystems shall be reliable and readily maintainable to minimize support cost (parts and labor) over the useful life of the equipment. Reliability shall be enhanced by the use of redundant standby systems or equipment by sizing equipment with additional capacity and by providing reliable sources of power to the systems or equipment. Designs shall attempt to achieve and maintain the following goals:

a. To maintain a consistently high level of system reliability throughout the service life of the equipment;

b. To achieve a mean time between maintenance actions (corrective and preventive) of not less than 90 days per system at attended sites or 90 days between visits at unattended sites;

c. To eliminate periodic maintenance except for remote maintenance monitoring system (RMMS) calibration and mechanical maintenance.

3.1.9 Economic analyses. Design for NAS Plan physical facilities shall consider the analysis of the costs to acquire, maintain, operate, and repair a building or structure (as defined 6.2.2) over the designated economic life (as defined in 6.2.2). Economic analyses shall be performed for all major systems and items of equipment. Economic analysis for energy-consuming facilities systems or equipment shall be in accordance with FAA-STD-033. All other economic analysis methods shall be in accordance with FAA Order 1800.2. The use of discount rates shall be in accordance with Office of Management and Budget Circular A-94.

3.1.9.1 Value criteria for physical facility designs. FAA policy requires selection of design types for which the construction of the facility will be economical, taking into consideration the entire life cycle cost of the physical facility. The designs shall be in accordance with accepted good engineering and architectural practices. Function shall be given foremost consideration, but consideration shall also be given to appearance so that results will be compatible with local environment. Regions have the responsibility for site adapting the National Standard Designs to local conditions as necessary, and for application of value engineering during supplemental design and during construction.

3.1.9.2 Physical facility economic life. Unless otherwise specified, the economic life of physical facilities shall be in accordance with Appendix I. Where no figure is provided, the economic life shall be twenty (20) years.

3.1.10 Provisions for the physically handicapped. Unless otherwise specified, or directed by FAA, all physical facilities shall be designed, constructed, or altered so they are accessible to, and usable by, the physically handicapped. The FAA will identify the specific work areas and job tasks of the physically handicapped.

3.1.10.1 Applicability. Except as otherwise stated herein, these requirements shall apply to the following physical facilities:

a. Constructed or modified by or on behalf of the FAA;

b. Leased in whole or in part by the FAA after 12 August 1968 after construction or alteration in accordance with plans and specifications of the FAA;

c. Financed in whole or in part by a grant or a loan made by the FAA after 12 August 1968 if such physical facility is subject to standards for design, construction, or alteration issued under authority of the law authorizing such grant or loan.

3.1.10.2 Governing authority. Provisions for the physically handicapped shall be in accordance with FAA Orders 4660.1 and 4660.2.

3.1.10.3 Mandatory accommodations. Mandatory accommodations for the physically handicapped shall be included in the design and construction of new physical facilities and modifications to existing physical facilities. They shall include, but not be limited to the following:

a. Stairs
b. Doors
c. Elevators
d. Toilets
e. Entrances
f. Drinking fountains
g. Floors
h. Telephones
i. Curbs
j. Parking areas
k. Vending machine areas
l. Convenience outlets
m. Light switches
n. Thermostat locations
o. Emergency alarms

3.1.10.4 Standard. Implementation of FAA policy regarding provisions for the physically handicapped shall be in accordance with the Uniform Federal Accessibility Standards.

3.1.10.5 Exemptions. All physical facilities shall accommodate the physically handicapped except for those exempted facilities or portions of facilities which are unmanned or must be manned entirely with personnel without physical handicaps. Exempted physical facilities will be identified by the FAA.

3.1.11 Human factors considerations. Human factors shall be evaluated in the design and construction of the project in order to obtain optimum performance of the individual in the most cost effective manner. The factors that shall be considered include, but shall not be limited to, the proper operational environment, personnel safety, and user acceptance. Human-environment trade-off studies shall be performed in the concept phase to ensure that the human resource capability requirements established are both realistic and cost effective.

3.1.12 Occupational safety and health. All designs, construction, on-site design and construction activities, and equipment operation shall be in accordance with the applicable requirements of the Occupational Safety and Health Administration (OSHA) and FAA Order 3900.19.

3.1.13 Design data summary handbook. Unless otherwise directed, a design data summary handbook shall be presented for review at the interim and final stages of the design effort. The handbook shall contain the following information:

a. Code analysis;

b. Design assumptions and parameters for each architectural or engineering discipline;

c. Test reports and findings;

d. Design calculations for each architectural or engineering discipline;

e. A verification matrix (as defined in 6.2.2) in the introductory pages of the Handbook.

3.1.14 Mechanical and electrical systems handbook. Unless otherwise directed, a handbook covering the description and operation of the mechanical and electrical systems shall be prepared by the architect or engineer (A/E) for each facility. The handbook shall provide a total systems overview of the operation and interface of each mechanical and electrical system. This shall be provided through the use of schematics, one line diagrams, and written descriptions. In addition, it shall include the manufacturers' catalogs, installation and operation instructions, routine maintenance required, photographic cuts, and diagrams of the equipment used as the basis of the design.

3.1.15 Mechanical and electrical systems instruction book. A system or subsystem description, operations, and maintenance instruction book manuscript shall be prepared for major and complex systems by the A/E when specified in the engineering requirement or task order. This instruction book shall provide a physical and functional description of the mechanical and electrical systems, subsystems and interfaces. The instruction book shall be companion to and supplement the design drawings and specifications to provide concise explanations of design intent with regard to system or subsystem configuration, sequence and modes of operation, capabilities and limitations. The instruction book shall be organized and include material in accordance with requirements of FAA-D-2494. The specification shall include the requirement that the construction contractor further expand and develop the instruction book as defined in FAA-D-2494. Specific system operation and maintenance data on the brands and models of installed equipment which were not available until after construction shall be added to the instruction book by the construction contractor.

3.1.16 Provisions for remote maintenance monitoring system (RMMS). Provisions for RMMS shall be in accordance with NAS-MD-790 and NAS-MD-793. Where specified, architectural, mechanical and electrical systems and equipment which have a direct effect upon the proper and reliable functioning of and the security of flight operations equipment, shall have provisions for remote maintenance monitoring. The systems and equipment shall include, but shall not be limited to, door locks and other building security systems, environmental control and fire protection systems and critical and essential electrical systems. Building security systems shall have the capability of sounding an alarm and reporting unauthorized entry via the RMMS.

3.1.17 FAA signage. FAA signage shall be in accordance with FAA Order 1365.1.

3.2 Civil engineering. This section provides basic civil engineering standards for design and construction of NAS physical facilities.

3.2.1 Site survey. This section defines the minimum requirements for a boundary and topographic site survey for design and construction of NAS physical facilities.

3.2.1.1 General. The survey shall include all field work necessary, including review of pertinent public records, to accurately determine the property lines and existing physical conditions of the site, establish bench marks, monument markers and record the information and the required data on a topographic and boundary survey drawing.

3.2.1.2 Topographic survey. The topographic survey shall graphically represent the site, including location of existing structures, utilities, cables, and the extent of trees and vegetation on the site. Except for densely wooded sites or sites larger than 1/4 acre, all trees six (6) inches or more in diameter shall be identified and located. For densely wooded sites or sites larger than 1/4 acre, the tree line shall be noted and labeled as wooded or densely wooded, etc., as appropriate. Topographic information shall include an area outside the limits of the site boundary to provide adequate information to blend the site grading into the surrounding terrain.

3.2.1.3 Boundary survey.

3.2.1.3.1 Property description. The survey drawing shall contain or be supplemented by a legal description of the property.

3.2.1.3.2 Bench mark. A bench mark referenced to any established datum shall be marked on a permanent object adjacent to the site and be clearly located and described on the survey drawings. All bench marks shall be referenced to mean sea level or national reference.

3.2.1.3.3 Boundary lines. Boundary lines of the site shall be shown in bearings and distances.

3.2.1.3.4 Property corners. All corners of the site and other boundary line intersections not previously marked shall be identified and marked. The location and description of each marker shall be shown on the survey drawings.

3.2.1.3.5 Reference points. All markers shall be referenced to semi-permanent points of a conspicuous nature such as existing buildings, runway intersections, bridge abutments, etc., where possible. The location and description of each reference point shall be shown on the survey drawings.

3.2.1.3.6 Easements. The location description and dimensions of all easements of record and rights-of-way required for FAA construction of communication and control lines, power transmission lines, access roads, sewer, water, or fuel lines, etc., shall be shown on survey drawings.

3.2.1.3.7 Survey record drawings. Survey record drawings shall be prepared at a scale of not less than one inch equals 20 feet and a contour interval of 1 foot.

3.2.1.4 Coordination of controls.

3.2.1.4.1 Horizontal controls. Horizontal controls shall be tied to federal and state coordinate systems if such systems are accessible. Otherwise, they shall be tied to the local control system.

3.2.1.4.2 Vertical controls. Vertical controls shall be tied to local control datum. All local control datum used for design and construction of NAS physical facilities shall reference mean sea level.

3.2.1.4.3 Accuracy requirement of control surveys. Surveys shall be of an accuracy accepted locally for legal property descriptions.

3.2.2 Subsurface exploration.

3.2.2.1 Foundation design and site adaptations. Foundation design and site adaptations shall be based on soil exploration and analyses performed by a soils engineer licensed in the state where the facility is located.

3.2.2.2 Exploration and testing. A site exploration shall be performed. The requirements for field and laboratory work shall be coordinated with the proposed site layout and facility design to ensure that the data obtained will be sufficient to complete the necessary civil and structural design of the facility.

3.2.2.3 Soil reports. Unless otherwise stated in the engineering requirement or task order, a report containing an evaluation of site conditions and definitive recommendations for foundation and pavement designs shall be prepared. The report shall include all data collected in the field exploration and laboratory testing programs. The report shall also include data on the soil resistivity in order to determine the requirements for corrosion protection.

3.2.3 Site development.

3.2.3.1 General. The main objectives of site development and design for new and modified existing NAS physical facilities shall be as follows:

a. Obtain an integrated relationship of all elements of new and modified NAS physical facilities (such as structures, land-use areas, utilities, roads, and parking areas) to each other and the overall site to provide functional operational efficiency and construction economy;

b. Recognize and take full advantage of physical site characteristics to avoid excessive expenditures for such items as grading, foundations, drainage, roads, utilities, and subsequent ground maintenance.

3.2.3.2 Earthwork and grading. Site earthwork and grading design shall be planned with the following principal objectives:

a. Preservation of the natural character of the the site by minimum disturbance of existing ground forms and meeting satisfactory ground levels at existing objects to be saved;

b. Optimum on-site balance of cut and fill;

c. Avoidance of earth banks requiring costly erosion-control measures;

d. Disposal of surface run-off from site without erosion, and directing the surface run-off toward existing watercourse or to existing drainage systems.

e. Avoidance of changing the existing water course.

3.2.3.3 Erosion and sedimentation control. Erosion and sedimentation control measures shall be in accordance with applicable county and state approved standards. Erosion and sediment control measures shall be provided in order to ensure that the environmental stability of the construction area is not degraded. Local practice and conditions shall dictate the type of erosion and sedimentation control to be used at a given location. The major objectives of erosion and sedimentation control shall be the following:

a. Keeping disturbed areas to a minimum;

b. Stabilizing disturbed areas as soon as practical;

c. Maintain low velocities for storm water runoff;

d. Protecting disturbed areas from erosion due to storm water runoff;

e. Retaining sediments within the site.

3.2.4. Site utilities. Provision of utilities essential (as defined in 6.2.2) to efficient operation and of adequate size to serve future requirements shall be evaluated in the early planning stages to avoid conflicts in the design and layout of the various utility lines. Planning of utility lines shall take into consideration items such as the following:

a. Utility easements or rights-of-way;

b. Location, size and elevations of sanitary sewers, storm drains or open drainage, drain inlets and manholes;

c. Location, elevation and size of water supply, gas, heat transmission mains and electrical service;

d. Location and size of street lighting and telephone lines, including pole and manhole locations;

e. Location of fire alarm call boxes.

3.2.4.1 General. Design and construction of site utilities shall be in accordance with the codes and regulations applicable in the region of the project site. The following shall be the minimum standard requirement for NAS physical facilities.

3.2.4.1.1 Appearance. Careful consideration shall be given to the location of poles, transformers, vaults, meters, pressure reducing station piping and valving, and other utility items to avoid detracting from building appearance. Complete underground utility service shall be evaluated for all major buildings on an installation where above ground or overhead service would conflict with the desired architectural character or where required to eliminate electromagnetic interference (EMI) or prevent obstructions on airport surfaces.

3.2.4.1.2 Underground lines. Underground lines shall be located so that minimum effort and cost would be required for excavation when required for maintenance. Location of all types of underground utility lines under roads, sidewalks, parking lots, paved terraces and other paved areas shall be avoided to the greatest extent possible. Underground utility lines, mains and conduits shall be located at the minimum depth

necessary and shall be located in ducts when economically feasible. All underground lines shall be marked on the surface with adequate numbers of concrete markers at turns and 300 feet maximum intervals and by a continuous strip of yellow or red plastic tape buried 12 inches below surface.

3.2.4.1.3 Electrical. Every effort shall be made to place electrical distribution and telephone lines underground. Where economic or technical reasons require overhead construction, electrical distribution lines shall be located where practicable along streets or roads to avoid the use of separate poles for street lights.

3.2.4.1.4 Water and sewage lines. Water and sewage lines shall be located along easements for the shortest run. Where practical, consideration shall be given to locating water and sewage lines along streets or roads or designated utility strips.

3.2.4.1.5 Telephone lines and signal cables. For economy, telephone lines and signal cables shall be carried on the same poles. Underground installation of telephone lines and signal cables, including installation in manholes and handholes, shall be in accordance with FAA-C-1391.

3.2.4.2 Storm drainage. The facility site shall be protected against damage from storm and surface runoff with consideration given to the damaging effect of storms more severe than the design storm. The storm drainage system, including gutters, drain, inlets and culverts, shall be designed to carry the anticipated runoff, including runoff from melting snow, and inlets shall be provided where necessary to intercept surface flow. Development of undeveloped areas may have a noticeable effect on installation drainage facilities; major alterations or extensions to storm sewers and drainage channels may be required due to the location and design of new facilities.

3.2.4.3 Sanitary systems.

3.2.4.3.1 General. All sanitary wastes generated at NAS physical facilities shall be transmitted and discharged into an existing sewage system or into an on-site treatment system. The Environmental Protection Agency (EPA) requires that a permit be obtained for each facility with a sewage treatment system that discharges effluent beyond the property line. This permit defines the required condition of the treated effluent and may vary from site to site.

3.2.4.3.2 Sewage disposal systems. The type of sewage disposal system used will depend upon site conditions and economic analyses. The most economical and practical system shall be provided. The sewage disposal system shall be compatible with toilet facilities in 3.3.4.7 and portable toilets in 3.5.3.1.2.

3.2.4.3.2.1 Septic tank system. Septic tank systems shall be used where sewage discharge capacity warrants their use in the event that connection to an existing sewage system or connection to or the development of an on-site treatment system is not feasible. The septic tank system shall be in accordance with state and local health standards.

3.2.4.3.2.2 Aerobic system. Where economically and environmentally advantageous, aerobic sewage disposal system may be used in lieu of the septic tank system.

3.2.4.4 Water supply system. The water system shall supply the needs for domestic, industrial and fire fighting purposes of the facility. Whenever possible, pressurized treated water shall be purchased from nearby public or private sources.

3.2.4.4.1 Domestic water requirements criteria. Domestic potable water shall be supplied under the following condition as minimum requirements.

a. At facilities having conventional flush toilet systems as defined in 3.5.3;

b. At portable toilet sites equipped with lavatories.

3.2.4.4.2 Water sources. Water sources shall be selected from the following options.

3.2.4.4.2.1 Purchased water supply.

a. Nearby public utility shall supply water under pressure via water lines and control valve.

b. Water tanker truck shall provide water when a public or ground water supply source is not available.

c. When purchased or ground water supplies are not available or not feasible, then bottled water service shall be provided, or FAA personnel shall be required to supply their own drinking water.

3.2.4.4.2.2 Ground water supply systems. Ground water supply systems from springs or driven, bored, or drilled water wells shall be used to provide potable water to facilities not having access to public water system.

3.2.4.4.2.3 Surface water supply systems. Surface water supply systems which collect rain water runoff by gravity into concrete cisterns shall be used in lieu of purchased or ground water where economically more feasible and where there is sufficient quantity of rainfall to warrant the use of these systems.

3.2.4.4.2.4 Water well pumps. Water well pumps shall be designed to operate at least five years without maintenance. Pumps shall be self-priming and shall be equipped with protective devices to ensure reliability.

3.2.4.4.2.5 Water treatment systems. Water treatment shall be provided for all non-purchased sources of water. The water treatment system shall include chlorination, filtration, and softening as required to produce the required quantities of acceptable quality water.

3.2.5 Vehicular and pedestrian access.

3.2.5.1 Access roads or street systems. Final siting and layout of access road and street systems shall be approved by FAA.

3.2.5.1.1 Access roads. Access roads with turn around areas shall be provided to all FAA facilities or installations where a road is considered to be the best means of ingress and egress. Determination of need shall be based on frequency of use, travel time, and comparative costs. Where these access roads are on airports and intersect or terminate at paved runways or taxiways, the initial 300-feet adjacent to the runway or taxiway shall be paved. The number of access roads within the runway primary shall be kept to a minimum. At no time shall an access road be constructed parallel to a runway closer than 200-feet edge to edge and when parallel to a taxiway, 100-feet edge to edge.

3.2.5.1.2 Street systems. Streets within the project area, where applicable, shall provide convenient and safe access for deliveries, collection, fire protection, maintenance and repair, and other essential services.

3.2.5.2 Road construction. All roads shall be of the most economical type that will provide satisfactory and safe transportation of personnel, equipment, and material in the types of weather and climatic conditions normally encountered at the location.

3.2.5.3 Criteria for design. Roadway widths, geometry, gradients, site-distances, and intersections shall be in accordance with state and local requirements.

3.2.5.4 Vehicle parking. Vehicle parking shall be in accordance with FAA Order 4660.1.

3.2.5.4.1 General. It is FAA practice to obtain necessary parking accommodations concurrent with the acquisition of a new physical facility.

3.2.5.4.2 Official vehicle parking. Parking accommodations shall be at or near FAA physical facilities for all official vehicles required for the proper functioning of the FAA at that location.

3.2.5.4.3 Visitor parking. Parking accommodations at or near FAA physical facilities shall be provided for visitors based on the results of site specific surveys.

3.2.5.4.4 Employee parking. Essential employee parking accommodations shall be provided at or as close as practical to the FAA physical facility.

3.2.5.4.5 Parking for the physically handicapped. Parking for the physically handicapped shall be provided where applicable.

3.2.5.4.6 Motor vehicle heater receptacles. Motor vehicle heater receptacles shall be provided in each parking lot space at locations designated by the FAA, in areas located in heating (winter) Zones I and II, (Table II) or otherwise in areas where automobile tank or engine block heaters are installed in automobiles and similar vehicles. Receptacles shall be minimum NEMA standard 20 amp weatherproof type.

3.2.5.5 Walks. The walkway system shall be designed to provide convenient and safe pedestrian access and circulation within the project area, and shall be accessible by the physically handicapped where applicable.

3.2.6 Fencing. Fencing shall be in accordance with FAA-E-2065. Grounding provisions shall be in accordance with FAA-STD-019.

3.3 Architecture. This section provides basic architectural standards for design and construction of NAS physical facilities. The intent is to provide the NAS with facilities that are efficient, reliable, and economical to operate and maintain.

3.3.1 General architectural design considerations. FAA national standard designs shall comply with the Uniform Building Code, Uniform Building Code Standards, and Uniform Fire Code. All national standard designs shall be designed to UBC Zone III seismic requirements. All site adapted architectural design shall comply with recognized national, standard, or uniform codes and standards applicable to the specific facility location. Recognized codes and standards for site adapted designs include the following:

a. The BOCA Basic/National Building Code

b. Fire Protection Handbook

c. National Fire Codes

d. Standard Building Code

e. Uniform Building Code

f. Uniform Building Code Standards

g. Uniform Fire Code

3.3.1.1 Site planning. Site planning and the locations of facilities may be predetermined by the airport master plan or by an airport layout plan. However, the ultimate responsibility for the development of the site shall rest with the architect and engineers. Site planning and development shall be in accordance with FAA Order 4660.1.

3.3.1.2 Landscaping. Planting of trees, shrubs, and ground cover for esthetic, ecological, and environmental purposes shall be included as an integral part of the design. Landscape design for large sites with difficult topography and environmental problems shall be performed by a qualified professional landscape architect.

3.3.1.3 Future expansion. Future expansion of new facilities shall be taken into consideration at the initial planning stage. Designs for expansion of existing buildings shall ensure minimum disruption and interference to the facilities operations during construction activities. Any design approach for expanding existing buildings shall be formulated after an on-site building survey has been completed. The architectural character of the existing building, construction, and age of the facility shall be evaluated.

3.3.2 Organization of interior spaces. Organization of interior spaces shall be in accordance with FAA Order 4660.1. Administrative and extraordinary technical requirements will be provided to the architect/engineer by the FAA. The functional requirements of the facility with emphasis on efficiency, economy and flexibility of the layout of the interior spaces shall be evaluated. Whenever electric heat is used at a major facility, adequate space shall be provided to accommodate gas and oil fired heating equipment as alternative sources of heat.

3.3.3 Architectural acoustics. Control of both internal and external sound sources shall be evaluated in the design. When and where possible, the orientation of the building and the room arrangements within the building shall be planned to reduce noise penetration to the spaces. Where buildings are located in close proximity to an airport, special consideration to reduce aircraft noise transmission to the building shall be evaluated early in the design phase. Generally two types of sound control are required:

a. Sound attenuation for control of disturbance from high energy noise levels produced by aircraft engines, engine generators, and mechanical equipment;

b. Acoustical control for minimizing disturbances from intrusive speech and other noises and ensuring a measure of privacy for the conduct of business functions.

3.3.4 Construction systems.

3.3.4.1 Framing. The selection and design of the framing system shall be based upon economical considerations of the functional, architectural and structural requirements. The selection of the framing system may be influenced by:

a. Availability of materials;

b. Local labor and construction practices;

c. Mandatory standard drawings and specifications for certain types of NAS buildings;

d. Criteria and recommendations for design of structures in typhoon, hurricane and other high wind areas;

e. Seismic considerations.

3.3.4.2 Walls. Exterior wall construction materials for buildings shall be selected on the basis of architectural appearance, energy conservation, low maintenance, durability, and where appropriate, noise reduction and compatibility with existing nearby buildings. Aluminum window frames and window wall systems shall conform to applicable standards of the Architectural Aluminum Manufacturer's Association (AAMA).

3.3.4.3 Floors. Primary considerations shall be strength, fire resistance, and economy. The design and construction of the floor system shall be such that its integrity and that of the equipment placed on it is not diminished during a typical earthquake anticipated to occur in the seismic zone upon which the design is based. The floor system may also be influenced by:

a. Flexibility in regard to future expansion;

b. Floor depth;

c. Sound and vibration transmission;

d. Suitability of the floor structure to surface finishes;

e. Routing of utilities;

f. Appearance, with respect to exposed undersides;

g. Electrostatic discharge (ESD).

3.3.4.3.1 Foundation and slab-on-grade floors. Design considerations of foundation and slab-on-grade floors shall include the results of the subsurface exploration, the site physical characteristics, and location of site utilities.

3.3.4.4 Roofs. Roofs shall have a useful life of at least the economic life of the facility, but not to exceed twenty (20) years.

3.3.4.5 Pre-engineered buildings. Selection of building type shall be based on economy and suitability to satisfy space requirements, such as clear span, clear height, and area. Performance standards shall not be reduced below those necessary for similar buildings designed for conventional construction. Special emphasis shall be given to the effects of wind, hurricanes and salt laden air and corrosive atmospheric conditions. Criteria for varying climates shall be applied to the design of pre-engineered buildings as specified in this standard.

3.3.4.6 Mobile facilities and systems. Mobile air traffic control, navigation, and communications systems are installed in their own special structures or trailers. Land and site requirements for mobile facilities and systems will be provided by the FAA.

3.3.4.7 Toilet facilities. Toilet facilities shall be provided at FAA physical facilities in accordance with FAA Order 6960.1.

3.3.5 Electrostatic discharge control. The design of walls and floors for designated electrostatic discharge controlled areas shall be in accordance with FAA-STD-019.

3.3.6 Finishes. Interior and exterior finishes shall be compatible with those of the existing physical facility and the architectural scheme of the nearby facilities. Finishes shall be low maintenance materials selected on the basis of anticipated use, life cycle cost impact, fire and safety requirements, and suitability for the environment. In general, decor standards shall be in accordance with FAA Order 4660.1. Finishes for airport traffic control towers (ATCT) and terminal radar approach control facilities (TRACON) shall be in accordance with FAA Order 6480.7.

3.3.7 Architectural sheet metal. Architectural sheet metal such as roof drainage, gravel stops, facia, flashings, copings, expansion joints, metal roofs, skylights, louvers, sunshades, metal decking, etc. shall be in accordance with SMACNA Architectural Sheet Metal Manual.

3.3.8 Building security systems. Except for fire protection, building security systems shall be in accordance with FAA Orders 1600.6B and 1600.54. Physical security measures are required to ensure reliable operation of the NAS at both manned and unmanned sites. Security requirements shall be incorporated into planning and design for NAS facilities to meet the following goals:

a. Protect personnel, data and information, equipment, and property;

b. Prevent unauthorized entry into NAS facilities;

c. Control authorized entry;

d. Protect sensitive data, information and areas;

e. Protect and minimize damage from espionage, sabotage and other deliberate acts intended to disrupt normal operation.

3.3.9 Elevators. Elevators shall be in accordance with ANSI A17.1.

3.3.10 Obstruction marking. Obstruction marking shall be provided in accordance with FAA AC 70/7460-1.

3.4 Structural engineering. This section provides basic structural engineering standards for designs of all new and modified NAS physical facilities. The intent is to provide the NAS with a building system that is efficient and economical to construct and to maintain.

3.4.1 General structural design considerations. FAA National Standard Designs shall comply with the Uniform Building Code, Uniform Building Code Standards and Uniform Fire Code. Except as modified herein, all site adapted structural designs shall comply with recognized national, standard, or uniform codes and standards applicable to the specific facility location. Recognized codes and standards for site adapted designs include the following:

a. The BOCA Basic/National Building Code

b. Fire Protection Handbook

c. National Fire Codes

d. Standard Building Code

e. Uniform Building Code

f. Uniform Building Code Standards

g. Uniform Fire Code

Except as modified herein, all designs, in addition, shall be in accordance with applicable standards of the following:

h. American National Standards Institute

i. American Institute of Steel Construction

j. American Welding Society

k. National Forest Products Association

3.4.2 Coordination. The structural system layout shall be properly coordinated with the architect. This joint effort is particularly essential in seismic and high wind areas where distribution of lateral forces and layout of load-resisting elements are critical in establishing the earthquake and wind resistance for structures.

3.4.3 Selection of systems and materials. Structural systems and materials shall be suitable for FAA physical facilities, capable of carrying the required loads, and compatible with fire protection requirements and architectural and functional concepts. In choosing materials for specific projects, the following shall be evaluated:

a. Site environment including climate, subsurface condition, accessibility, wind velocity, and seismic readings;

b. Skill and experience of prospective contractors;

c. Design life and life cycle costs;

d. Availability of labor and materials;

e. Feasibility of preassemblying or precasting major structural elements.

3.4.3.1 Concrete. Reinforced concrete structural members shall be proportioned for adequate strength using load factors and strength reduction factors. Non-prestressed reinforced concrete members may be designed using service loads and permissible service load stresses in accordance with Alternate Design Method set forth by the UBC.

3.4.3.2 Structural steel. Structural steel shall be in accordance with the standards of AISC.

3.4.3.3 Wood. Wood for structural purposes shall be in accordance with National Design Specifications for Stress Grade Lumber and its Fastenings.

3.4.4 Seismic loads. Seismic design shall be in accordance with the UBC. All national standard designs shall be designed to UBC Zone III seismic requirements. Seismic loads for site adapted designs shall be in accordance with UBC. In any major modification or expansion of existing buildings, structural investigations shall include an analysis of the impact on the seismic response of the existing structure. Seismic load considerations shall include, but not be limited to the following.

3.4.4.1 Structural and siting considerations. Seismic structural and siting considerations may conflict with functional considerations in building design. Concept designs and installation master plans for all major or complex buildings, including but not limited to large administrative buildings, communications centers and other similar facilities, shall include seismic considerations as well as functional, flexibility

and siting considerations in order that all requirements may be optimally integrated. Structures shall not be sited over active geologic faults, in areas of instability subject to landslides, where soil liquefaction is likely to occur, or in coastal areas subject to damage by hurricanes, tsunami or typhoons.

3.4.4.2 Seismic considerations. Seismic considerations may require limits on the height of structures and design configurations. Consolidation of several small facilities, possibly serving widely different functions, may be desirable in limiting structural and foundation costs. Since different functions in the same building may be of different criticality, (some required to operate post earthquake, some not) functions shall be studied to group those of greater or lesser criticality in order to separate the building into different occupancy types for seismic design.

3.4.4.3 Seismic design requirements. Basic functional relationships essential to flight safety and mission integrity shall not be compromised for nominal structural cost savings. Where necessary, trade off studies based on life cycle costs shall be made to determine optimum building design. In such studies the cost of lost efficiency through less than desirable functional design and the risk cost of less than ideal seismic design shall be included if quantifying such cost is feasible.

3.4.5 Design for typhoon and hurricane areas. Structures to be constructed in typhoon and hurricane areas shall be designed so that structural integrity and continuity are provided from foundation to roof, irrespective of the materials selected for the facility. All components of the structures shall be positively tied together in order to establish an overall integrated resistance to high wind effects. In designing drag sensitive structures, such as stacks, guyed towers and suspended pipelines, the effect of maximum wind forces, including pulsating forces on such structures, shall be considered.

3.4.6 Calculations. All structural calculations shall be provided in an orderly manner in the Design Data Summary Handbook and shall clearly show that the structures can adequately support the design loadings. The calculations shall clearly show allowance for problems such as, but not limited to, soft ground, stability, settlement, impact, waterproofing, and fire resistance in the design of the buildings and structures. Where the structural system cannot be analyzed on a rational basis, acceptability of the load-carrying capacity of the system shall be determined by suitable load or model tests.

3.4.7 Engineering regulations. The quality, testing and design of the materials of construction used structurally in buildings or structures shall conform to the requirements specified in the UBC and to the applicable standards listed in the UBC Standards.

3.5 Mechanical engineering. This section provides basic engineering standards for design of all heating, ventilating, air conditioning (HVAC) systems and plumbing and sanitary systems which are efficient, reliable and economical to operate and maintain. FAA national standard designs shall comply with the Uniform Building Code, Uniform Building Code Standards, and Uniform Fire Code. All site adapted mechanical engineering design shall comply with recognized national, standard, or uniform codes and standards applicable to the specific facility location. Recognized codes and standards for site adapted designs include the following:

a. The BOCA Basic/National Mechanical Code

b. The BOCA Basic/National Plumbing Code

c. Fire Protection Handbook

d. National Fire Codes

e. National Standard Plumbing Code

f. Standard Mechanical Code

g. Standard Plumbing Code

h. Uniform Fire Code

i. Uniform Mechanical Code

j. Uniform Plumbing Code

Except as modified herein, all designs, in addition, shall be in accordance with the following:

k. American Conference of Governmental and Industrial Hygienists (ACGIH)

l. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE)

m. American National Standards Institute (ANSI)

3.5.1 General mechanical design considerations. Selection of systems and equipment shall be of current proven technology. All electrical systems such as motors, motor controls, and instrumentation that are an integral part of a mechanical system shall be in accordance with 3.6.

3.5.2 Temperature and humidity systems. This section establishes requirements governing design and installation criteria of temperature and humidity control systems in FAA physical facilities. Criteria for determining qualifying physical facilities are included.

3.5.2.1 Objectives.

a. Provide controlled environment to maintain stability, reliability and life of electronic equipment by reducing thermal strain and particulate contamination.

b. Maintain an acceptable working environment for maintenance and operating personnel by providing proper levels of temperature and humidity, and reducing particulate contamination, odor, noise, and excessive air velocities.

3.5.2.1.1 Qualifying criteria for providing temperature and humidity control equipment and systems. Temperature and humidity control equipment and systems shall be provided in accordance with the following criteria. Facilities are divided into three categories based upon facility type, occupancy, exterior climatic conditions and interior environmental conditions. As new types of facilities are developed, they will be classified under these categories and the lists will be revised accordingly.

3.5.2.1.1.1 Category One facilities. Category One facilities shall be provided with heating and air conditioning regardless of location and exterior temperature. Humidification equipment shall be provided where justification for this equipment is based upon one of the following:

a. History of low humidity-related problems at the facility;

b. History of low humidity-related problems at facilities having similar equipment.

Approval for providing humidification equipment is required from FAA and will be based on a study which demonstrates that benefits derived will fully justify installation and operational costs.

3.5.2.1.1.2 Category Two facilities. Category Two facilities (not in Category One) shall be provided with heating equipment. When either of the following conditions is encountered, air conditioning equipment and humidification equipment (when justified per 3.5.2.1.1.1) shall be provided.

a. Personnel are employed in the area for a total of forty (40) manhours per week, and the inside effective temperature meets or exceeds eighty (80) degrees Fahrenheit for twenty-five (25) days in any one year. Any number of occurrences during a single day in which this effective temperature is reached shall be regarded as only a single day towards this total. An 80°F effective temperature is met or exceeded with any combination of dry bulb and associated wet bulb temperatures as indicated in the following table.

TABLE I

80°F Effective Temperature Combinations	
°F Dry Bulb	°F Wet Bulb
76.5	76.5
77	74.5 or above
78	72.5 " "
79	69.6 " "
80	66.5 " "
81	63.5 " "
82	60.5 " "
83	56.5 " "
84	53 " "
85° and above with any Wet Bulb	

b. Serious maintenance or operating problems would occur where the outside temperature is ninety-three (93) degrees Fahrenheit or higher for an average of one hundred (100) or more hours per year during the months May through October.

3.5.2.1.1.3 Category Three facilities. Category Three facilities (not in Categories One or Two) shall be provided with heating equipment. When either of the following conditions is encountered, air conditioning equipment and humidification equipment (when justified per 3.5.2.1.1.1) shall be provided.

a. The facility is located in an area where the outside environment contains dust, smoke, a corrosive atmosphere or noxious odors to such an extent, that without air conditioning, the resulting indoor environment will have a serious adverse effect on the operation or maintenance of equipment or the health and well-being of personnel.

b. Station records indicate that a health hazard exists or that there has been significant malfunctioning or deterioration of equipment due to temperature or humidity extremes or variations.

In addition, approval for providing air conditioning equipment in these two special cases is required from the FAA and will be based on a case-by-case study which demonstrates that the benefits derived will fully justify the installation and operational costs.

3.5.2.2 Design criteria.

3.5.2.2.1 Interior environment. The interior environments shall be as provided below for the various conditioned spaces. Special interior environmental conditions for extraordinary applications will be provided by FAA.

3.5.2.2.1.1 Standard summer and winter temperature/humidity conditions. The standards for unoccupied space shall apply to occupied space whenever the space is to be unoccupied for a period of 8 hours or more. Gradual changes between occupied and unoccupied temperature/humidity considitions may be required in order that equipment performance is not affected.

3.5.2.2.1.1.1 Air traffic control, radar, communications and electronic equipment areas.

3.5.2.2.1.1.1.1 At ARTCCs.

	Temp (°F)	%RH
Winter	65 ± 2	30-55
Summer	78 ± 2	30-55

3.5.2.2.1.1.1.2 At other FAA physical facilities. Except for certain physical facilities referenced below, the internal environmental conditions of air traffic control, radar, communications and equipment areas shall be:

	Unoccupied		Occupied	
	Temp (°F)	%RH	Temp (°F)	%RH
Winter	55 ± 3	30-55	65 ± 3	30-55
Summer	85 ± 3	30-55	78 ± 3	30-55

The building space of the following facilities shall be maintained at 65°F (winter) and 78°F (summer) regardless of building occupancy status.

a. Automated Radar Terminal System: ARTS I, II, III, IIIA, TPX-42.

b. Airport Surveillance Radar: ASR-4, 5, 6, 7, 8.

c. Air Route Surveillance Radar: ARSR-3.

d. Instrument Landing System (ILS)P: AIL Type 55, Mark III, AN/GRN-27.

e. Waveguide Glide Slope.

f. Radar Microwave Line Repeater: All types.

g. Air Traffic Control Beacon Interrogator (ATCBI): Beacon only.

h. Other facilities as identified by FAA.

Unless otherwise specified, at aunmanned facilities located in areas of high humidity, the air-conditioner shall be oerpated below the stated temperature as necessary to reduce the relative humidity inside the building to 90%.

3.5.2.2.1.1.2 Air traffic control automated data processing equipment spaces.

3.5.2.2.1.1.2.1 At ARTCCs.

	Temp (°F)	%RH
Winter	65 ± 2	45 - 55
Summer	73 ± 2	45 - 55

3.5.2.2.1.1.2.2 At other FAA physical facilities. The internal environments of air traffic control automated data processing equipment spaces shall be the same as for air traffic control, radar, communications and electronic areas at these facilities.

3.5.2.2.1.1.3 Administrative areas, offices, and living quarters.

3.5.2.2.1.1.3.1 At ARTCCs.

	Unoccupied Temp (°F)	Occupied Temp (°F)
Winter	55 ± 3	65 ± 3
Summer	78 ± 3	78 ± 3

3.5.2.2.1.1.3.2 At other FAA physical facilities.

	Unoccupied Temp (°F)	Occupied Temp (°F)
Winter	55 ± 3	65 ± 3
Summer	-	78 ± 3

3.5.2.2.1.1.4 Electric service room or transformer vault. The electric service room or transformer vault shall be mechanically ventilated. The ventilation system shall be designed for 10°F rise over outside air ambient temperature.

3.5.2.2.1.1.5 PCS battery room space temperature. The PCS battery room space temperature shall be 65° minimum and 10°F rise over ambient summer temperature not to exceed 104°F.

3.5.2.2.1.1.6 PCS room temperature. The PCS room temperature shall be from 40°F up to 10°F above outside air temperature, but not over 104°F.

3.5.2.2.1.1.7 Mechanical, electrical and engine generator rooms.

	Unoccupied Temp (°F)	Occupied Temp (°F)
Winter	50 min	65 min
Summer	Ambient +10°	Ambient +10°

3.5.2.2.1.1.8 Kitchens.

	Unoccupied Temp (°F)	Occupied Temp (°F)
Winter	55 min	65 min
Summer	-	95 max

3.5.2.2.1.2 Human occupancy factors. Human occupancy factors will be defined by the system specification, engineering requirement or task order.

3.5.2.2.2 Exterior design conditions. At individual locations and for site adaptation of National Standard Designs, exterior design conditions shall be determined in accordance with ASHRAE Handbook, Fundamentals Volume. For locations not covered by ASHRAE Handbook, exterior design conditions shall be in accordance with AFM 88-29. Records of temperature and humidity occurrence durations are available from the National Oceanic and Atmospheric Administration, Environmental Data Service and the United States Air Force Environmental Technical Applications Center. A compilation of this data should be available at the regions. At locations where temperature and humidity occurance duration records are not available, the records of the nearest place of similar elevation which are available shall be used by interpolation. On-site reading records may be used when available.

3.5.2.2.2.1 Climatic zones (as defined in 6.2.2). For multiple shelter and total package procurements and National Standard Designs, heating and air conditioning shall be provided with the equipment sized to the appropriate combinations of summer and winter climatic zones listed in Table II below.

Table II
Summer and Winter Climatic Zones

Summer Climatic Zones
(Air Conditioning)

Zone	Temperature
A	95° - 100°F DB[1] 75° - 80°F WB[2]
B	95° - 100°F DB 70° - 75°F WB
C	90° - 95°F DB 75° - 80°F WB
D	90° - 95°F DB 70° - 75°F WB
E	85° - 90°F DB 75° - 80°F WB

1 Dry bulb
2 Wet bulb

Winter Climatic Zones
(Winter)

Zone	Temperature
I	Below -20°F DB
II	-20°F to 0°F DB
III	0°F to +20°F DB
IV	+20°F to +40°F DB
V	Above +40°F DB

Special consideration should be given to those locations where the design temperatures exceed 100°F dry bulb and/or 80°F wet bulb.

3.5.2.2.3 Ventilation. Facilities with and without air conditioning shall be designed to provide natural outdoor air or forced ventilation of filtered outdoor air in quantities sufficient to limit room temperature rise to no more than 10 degrees above the outside temperature. Where air conditioning is provided in addition to ventilation fans, fan control shall be interlocked to shut down air conditioners to prevent simultaneous operation. Fan shall operate only upon failure of air conditioning to operate and when the outside air temperature is sufficiently low enough that cooling can be provided by the ventilation fan.

3.5.2.2.3.1 Industrial ventilation. Ventilation for industrial process areas such as carpenter shops, maintenance shops, engine-generator rooms and other similar spaces shall be in accordance with the ACGIH Manual on Industrial Ventilation.

3.5.2.2.3.2 Air filtration. Air cleaning systems shall conform to recommendations of ASHRAE Handbook, Systems Volume. Air cleaning systems and equipment shall be provided to minimize entry of contaminants into the ventilated or conditioned space or otherwise remove airborne contaminants from the space. Air filtration equipment shall be in accordance with ASHRAE Handbook, Equipment Volume.

3.5.2.2.3.2.1 High quality air filtration. High quality air filtration systems and equipment shall be used in heating, ventilating and air conditioning (HVAC) equipment serving critical areas. Pre-filtration shall normally be provided and shall be two-inch thick glass fiber disposable filters. In addition, disposable medium to high-efficiency final filters shall be used to maintain acceptable air quality. Standard filters shall have a minimum of 30% efficiency based upon ASHRAE Standard 52, atmospheric dust spot efficiency test. Electrostatic air filters may be used when justified by life cycle cost versus benefit analysis. Charcoal filters may be used in addition to particulate filters to maintain acceptable air quality for human occupancy in areas such as airports and industrial environments which are subjected to gaseous contaminants. Control of gaseous contaminants shall conform to ASHRAE Handbook, Systems Volume.

3.5.2.3 Load design and equipment selection.

3.5.2.3.1 Load design and equipment selection. The load design analysis shall be in accordance with the ASHRAE Handbook, Fundamentals Volume.

3.5.2.3.2 Equipment selection analyses. Systems analyses and equipment selection shall be in accordance with the ASHRAE Handbook, Equipment, Applications, and Systems Volumes and shall include an economic analysis based upon initial, operating, maintenance and replacement costs and expected life to justify selection on the basis of minimum life-cycle cost.

3.5.2.3.3 Duct design and pipe sizing. Duct design and pipe sizing shall be in accordance with ASHRAE Handbook, Fundamentals Volume.

3.5.2.3.4 Temperature and humidity systems and equipment controls. Temperature and humidity systems and equipment controls shall be in accordance with ASHRAE Handbook, Systems Volume and shall be designed to maintain the interior environments defined in this standard.

3.5.2.3.5 Sound and vibration control. Sound and vibration control shall be in accordance with ASHRAE Handbook, Systems Volume.

3.5.2.3.6 Air and water system balance. Air and water system shall be tested, adjusted and balanced in accordance with ASHRAE Handbook, Systems Volume. Duct leakage shall be limited and controlled.

3.5.2.4 Equipment selection criteria. Equipment selection criteria shall be determined on a case-by-case basis for the physical facility requiring the temperature or humidity control equipment. In addition the following criteria shall be applicable for the specific physical facility type.

3.5.2.4.1 Field and remote facilities. Temperature and humidity control systems and equipment shall be in accordance with FAA-C-2256.

3.5.2.4.1.1 Control action. For smaller facilities, single stage, ON-OFF cooling cycle shall be used. The equipment fan shall run continuously to circulate room air during the period of time that the equipment is operating or when there is a need for circulating air. The air temperature leaving the cooling equipment shall be 12 to 20°F lower than the room return air entering the equipment. When heat is required, heaters will cycle on demand as sensed by space thermostats, and air conditioners and vent fans shall be de-energized. Excessive cycling of equipment during partial loading conditions shall be minimized via staging of heating and cooling as applicable.

3.5.2.4.1.2 Multiple units. When one unit cannot prevent a temperature rise above a set point, two (or more) units shall be provided and operated as required to maintain proper space conditions. The thermostat settings of the secondary (backup) unit shall be 1 to 2°F higher than the primary unit, and the tertiary unit 1 to 2°F above the secondary, etc.

3.5.2.4.1.3 Combination systems. Combination systems which combine at least two of the multiple-refrigerant circuit units operating through a common control panel shall be considered as an option to multiple units where economically feasible.

3.5.2.4.1.4 Heat pumps. The use of heat pumps shall be considered wherever the heating system is likely to require electric resistive heating coils.

3.5.2.4.1.5 Auxiliary fan. Except at facilities equipped with air conditioners having a separate evaporator-ventilating unit or redundant air conditioners, all electronic facilities shall be provided with one or more auxiliary fans. The auxiliary fans shall provide emergency ventilation only. When the space temperature exceeds the prescribed set point by 10°F, or by any specified lower temperature difference, the fan(s) shall operate until normal space temperature is achieved. Fan control shall be equipped with an override relay to lock out heaters and air conditioners.

3.5.2.4.2 Larger FAA physical facilities. Larger FAA physical facilities shall be provided with central plant heating and cooling. Heat may be provided via air handling units by a heating water (hydronic) system, steam, or electric resistance coils. Cooling may be provided via air handling units by chilled water or direct expansion systems. HVAC Systems for ATCT/TRACON/ARTS facilities shall be in accordance with FAA Order 6480.7.

3.5.2.4.2.1 Multiple-refrigerant circuits. For larger facilities, multiple refrigerant circuits may be provided. This system usually consists of two separate cooling systems installed in one air handling unit and a single thermostat with two stages to control the individual cooling system.

3.5.2.4.2.2 Solar heating systems. Where economically feasible, solar heating systems shall be provided in accordance with ASHRAE Handbooks, Systems and Applications Volumes. Solar panels shall be vandal proof and shall not be installed where they will be subjected to shade from trees, buildings, or other structures. Freeze protection shall be provided.

3.5.2.4.3 HVAC systems power sources. HVAC systems power source shall be as follows:

a. Where facility power is provided via three electrical buses, i.e., critical, essential, and building service buses, all HVAC systems serving critical equipment shall be connected to the essential bus. All other HVAC equipment shall be powered from the building service bus. Standby engine generator power is provided to the essential and critical buses.

b. Where power is provided by two buses, i.e., critical and non-critical, HVAC systems serving critical equipment shall be connected to a portion of the non-critical bus which is connected to the standby power bus.

3.5.2.4.3.1 HVAC systems power sources for ATCT/TRACON/ARTS facilities. HVAC system power sources for ATCT/TRACON/ARTS facilities shall be in accordance with FAA Order 6480.7.

3.5.2.4.3.2 HVAC systems power sources for ARTCCs. The power sources for HVAC systems serving critical electronic mission equipment in ARTCCs shall be in accordance with FAA Order 6950.15.

3.5.2.4.4 Redundant systems. Redundant (back-up) systems and equipment, such as extra pumps, air handling units, ventilation fans, window air conditioning units, etc. shall be provided when required by the system specification, engineering requirement, or task order and when required to maintain FAA mission equipment reliability, availability and maintainability. The redundant equipment shall be sized with adequate capacity to handle normal facility HVAC load. Larger equipment such as cooling towers, chillers, and boilers shall be sized with extra capacity where justified.

3.5.3 Plumbing/sanitary systems and equipment. Plumbing/sanitary systems and equipment shall be provided at all NAS physical facilities as specified in FAA Order 6960.1 and herein.

3.5.3.1 Toilet systems. The toilet system shall be installed within the building where feasible. All exterior systems shall be approved by the FAA on a site-by-site basis.

3.5.3.1.1 Conventional water closets. Conventional water closets shall be either flush tank or flushometer valve type with either the common wash down, reverse trap or siphon jet bowl flush principle.

3.5.3.1.2 Portable and self-contained toilets. Portable and self-contained toilets shall be installed at remote sites or in areas where conventional systems are inaccessible or are not reasonably immediately accessible to personnel. Chemical toilets shall be either the self-contained cabinet or cabana type with chemical-additive water flushing unit, the individual self-contained unit utilizing reuseable fluid, and the chemical-additive water closet unit.

3.5.3.2 Plumbing fixtures. All plumbing fixtures shall be in accordance with nationally recognized codes and standards.

3.5.3.2.1 Floor drains. All floor drains shall have removable strainers and traps with minimum 2-inch water seal. Floor drains in engine generator rooms and similar areas which may receive spilled fuel or oil shall have their waste conducted through an oil separator from which separated oil is diverted to a waste oil storage tank.

3.5.3.3 Facility water systems. The facility water system shall conduct water from the water supply service lines to the indoor water outlets of the facility. The system shall include water distribution piping, pumps, and supply or pressure tanks.

3.5.3.3.1 Water pressure booster pump. Water booster pumps shall be provided at locations where the main water service pressure is less than 30 psig. Pumps shall be a duplex arrangement with a primary and standby pump automatically operated by level and/or pressure controls and an alternator.

3.5.3.3.2 Hydropneumatic/hydrocell tank system. Hydropneumatic/hydrocell tanks used with booster pumps in facility water system shall be constructed by heavy gauge steel and either galvanized or epoxy coated inside and outside. Corrosion protection shall be provide as required.

3.5.4 Sound and vibration control. Sound and vibration control shall be provided for, but not limited to HVAC systems, machinery, rotating equipment, plumbing systems, and electrical machinery and equipment. Sound and vibration control design methods shall be in accordance with ASHRAE Handbook, Systems Volume. Vibration control shall be coordinated with the requirements for seismic design.

3.5.4.1 Industrial sound levels. Sound levels in industrial spaces such as machine rooms, engine generator rooms and maintenance shops shall be in accordance with OSHA.

3.5.4.2 Outdoor sound levels. Outdoor sound levels produced by FAA equipment shall not exceed levels allowable by local codes and regulations and shall also be in accordance with FAA Order 1050.1 and, where applicable, FAA Order 5050.4.

3.5.4.3 Seismic requirements for support systems. Analysis of seismic loading shall be provided for all support systems, including pads for pad-mounted equipment. Seismic design shall be in accordance with the UBC and AFM 88-3, Chapter 10 of Chapter 13. All national standard designs shall be designed to a minimum of UBC Zone III seismic requirements. Seismic requirements for site adapted designs shall be in accordance with UBC.

3.5.5 Fuel and oil storage tanks. Fuel and oil, including waste oil, storage tanks shall be located for easy access for filling, pumping out, and maintenance. Fuel storage tank shall be sized for minimum 72 hours continuous operation of engine generators. Where common fuel tanks serve engine generators and boilers, the tank capacity shall be such that engine generators can be operated for 72 hours while simultaneously supplying fuel to the boilers. Installation of new tanks and corrective action for existing tanks, including spill prevention, containment measures, testing, and monitoring, shall be in accordance with the provisions of NFPA or state and local environmental protection regulations, whichever is more stringent. Tanks shall be warranted for minimum 25 years service life.

3.6 Electrical engineering. This section provides basic engineering guidance and standards for design of all interior and exterior electrical systems. The intent is to provide electrical systems that are efficient, reliable and economical to operate and maintain. FAA national standard designs shall comply with the Uniform Building Code, Uniform Building Code Standards, Uniform Fire Code and the National Electrical Code. All electrical work shall be in accordance with FAA Orders 6030.20 and 6950.2 and shall comply with recognized national, standard or uniform codes and standards. Recognized codes and standards for site adapted designs include the following:

a. The BOCA Basic/National Building Code

b. National Electrical Code (NEC)

c. National Electrical Safety Code

d. National Fire Code (NFC)

e. Standard Building Code

f. Uniform Building Code

g. Uniform Building Code Standards

h Uniform Fire Code

3.6.1 General electrical design considerations. All designs shall be of current proven technology. Systems and equipment shall be reliable, maintainable, readily available in the market place, and of high quality. Except as modified herein all electrical systems shall be designed in accordance with applicable publications of the following:

a. Illuminating Engineering Society (IES)

b. Institute of Electrical and Electronics Engineers (IEEE)

c. National Electrical Manufacturers Association (NEMA)

d. National Fire Protection Association (NFPA)

e. Underwriters Laboratories, Inc. (UL)

3.6.1.1 Polychlorinated biphenyls (PCB). All components of all electrical systems shall be free of PCBs.

3.6.1.2 Mechanical equipment coordination. The electrical design shall be closely coordinated with the mechanical design to ensure the required reliability and maintainability of both systems. This includes supplying

the required power quality and maintaining the continuity of the control and monitoring systems. The design shall ensure compatible functioning of any existing Central Control Monitoring System (CCMS).

3.6.1.3 Selective overcurrent protection. A proper, fully selective, overcurrent protection system shall be designed for all new electrical work. A complete design analysis shall be made and all design data and curves shall be included in the Design Data Summary Handbook.

3.6.1.4 Available fault current. Calculations shall be made on the entire electrical design to ensure that the equipment and conductors specified have the rating and withstand capability to exceed the fault currents available anywhere in the system for the required fault duration. These calculations shall be included in the Design Data Summary Handbook.

3.6.1.5 Existing electrical circuits. All designs shall ensure that any existing electrical circuits which must be altered, are reconnected as needed to maintain operation of the existing facility systems. The design shall identify any temporary electrical connections that may be necessary to maintain operation of all systems during construction.

3.6.1.6 Metering. Metering shall be fully coordinated with the utility company.

3.6.1.7 Spare capacity. Spare capacity of at least 25 percent shall be provided in all portions of electrical power distribution systems.

3.6.1.8 Facility specific requirements.

3.6.1.8.1 ATCT/TRACON/ARTS facilities. Electrical systems of ATCT/TRACON/ARTS facilities shall be in accordance with FAA Order 6480.7.

3.6.1.8.2 ARTCCs. Power distribution at ARTCCs shall be in accordance with FAA Order 6950.15.

3.6.2 Exterior electrical systems.

3.6.2.1 Overhead power distribution. Due to electromagnetic interference, the use of overhead power distribution should be avoided whenever economically feasible.

3.6.2.1.1 Conductors. Conductors shall have adequate strength for span lengths and loading conditions. In heavy storm areas where high reliability is required, insulated conductor, pre-assembled, sheathed (metallic or non-metallic), messenger-supported aerial cable shall be used. Other measures may be required in areas with highly corrosive atmospheric conditions such as near salt water or heavy industry.

3.6.2.1.2 Hardware components. Designs shall maximize the use of radio-freed insulators, and hardware components that prevent loosening of connections, even when wood members shrink.

3.6.2.1.3 Service drops. Service drop to buildings shall be underground from service pole into building. Primary service drops shall be underground from service pole to pad mounted transformer and underground from transformer secondary compartment into building. Service drops shall have surge protection in accordance with FAA-STD-019.

3.6.2.1.4 Wooden poles. Wooden poles used in connection with antennae, obstruction lighting, flood lighting, utility lines, and similar usages shall be in accordance with FAA-E-113.

3.6.2.2 Underground power distribution. Underground power distribution shall be installed in accordance with FAA-C-1391.

3.6.2.2.1 Underground cables. All underground conductors shall be annealed or medium-hard-drawn copper. Insulation material shall depend on the system voltage and the thermal, mechanical, and chemical effects involved in each particular application. All cables rated 2400 Volts or above and all cables exposed to the possible failure of other cables operating at these voltages shall be fireproofed in manholes, handboxes and other enclosures (as defined in 6.2.2). Except as provided herein, all multiconductor cables installed underground at FAA facilities shall be armored. Power cable shall be armored in accordance with FAA-E-2013, Type II. Control cable shall be armored in accordance with FAA-E-2042, Type 1B, 2B, or 3B. Telephone cable shall be armored in accordance with FAA-E-2072, Type II. Coaxial cables RG-11A/U and RG-35B/U shall be armored in accordance with FAA-E-2171 and FAA-E-2619, respectively.

3.6.2.2.1.1 Cables not requiring armor. Armored cables are not required under any of the following conditions:

a. When the cable is to be installed in an area free of rodents or insects likely to cause cable damage and damage due to frequent construction activities is not likely; the cable has a jacket specifically suited for direct earth burial; and the cable is no smaller in size than 1 conductor 8 AWG, or 6 pair 19 AWG;

b. When non-armored cable is indicated on approved standard drawings or specifications;

c. Where the cable is furnished, installed and maintained by local utility companies;

d. When the cable is to be installed in rigid steel conduit, rigid heavywall plastic conduit, or concrete-encased duct;

e. When the cable is to be embedded in sawed-cuts in runway pavement.

3.6.2.2.1.2 Protection. Protection in the form of rigid steel conduit, rigid heavywall plastic conduit, or concrete-encased duct for cables greater than that provided by armor shall be provided when the following conditions are present:

a. When the cables are to be installed under railroad tracks or paved surfaces such as roads, runways, aprons, and taxiways;

b. When the cables are to be installed in areas where heavy vehicular traffic or frequent construction activities are likely to cause cable damage;

c. When space is available in an existing rigid steel conduit, rigid heavy wall plastic conduit, or concrete-encased duct;

d. When critical operating requirements or severe site conditions require the additional protection of a duct or conduit system.

3.6.2.2.2 Direct burial systems. Direct burial systems shall be used only in areas that are rarely disturbed, where runs are long, and for roadway lighting systems.

3.6.2.2.3 Draw-in systems. Draw-in systems i.e., cable-in-duct, shall be provided where reliability is a major concern.

3.6.2.2.3.1 Duct lines. Duct lines shall be routed to avoid foundations for future (or existing) buildings and structures. Where communications lines are to run parallel to power lines, system shall be isolated in separate manholes or handboxes. Where possible, the ducts shall be run within the same concrete envelope. Power and communications ducts shall be kept clear of all other underground utilities. Positive drainage shall be provided for all duct lines. Traps in ductlines shall be avoided. Ducts shall drain toward accessible low points.

3.6.2.2.3.2 Manholes and handboxes. Manholes and handboxes shall be selected based on cable racking arrangement, method of drainage, adequacy of work space, and integrity of waterproofing. Pre-cast manholes and handboxes are preferred due to excellent waterproofing capabilities. Manholes and handboxes shall be spaced as necessary to prevent damage to cable insulation during installation. In no case shall spacing exceed 600 feet for straight duct runs or 300 feet where there is a bend in duct runs between manholes.

3.6.2.2.4 Cable loop systems. Cable loop systems at designated airports shall be in accordance with FAA Order 6950.23. Designs for underground power distribution shall consider the requirements imposed by existing or planned cable loop systems.

3.6.2.3 Transformers and distribution equipment.

3.6.2.3.1 Transformers. Transformers shall be selected based on ambient conditions, basic impulse insulation level, power utilization requirements, and life cycle cost analysis. The use of flammable transformer liquids should be avoided; however, if used, such transformers shall be located a minimum of 20 feet from egress paths and doors, windows, louvers, or other openings in building exterior walls.

3.6.2.3.2 Circuit interrupting devices. Circuit interrupting devices shall be rated in accordance with current carrying capacities and fault interrupting duties.

3.6.2.4 Lighting systems. All exterior lighting systems shall be designed in accordance with the Illuminating Engineering Society (IES), Lighting Handbook, and requirements of the American Association of State Highway and Transportation Officials (AASHTO). Site areas which shall be lit include, but shall not be limited to: entries, walkways between entry and designated parking areas, site entry gate, parking lot spaces, facility sign, and other specific site locations commonly active during hours of darkness. Appropriate lighting controls that limit lighting to the period of activity shall be provided.

3.6.2.4.1 Street lighting. Illumination level shall be 0.6 to 2.0 footcandles average maintained with 3:1 uniformity ratio. Illumination level on roadways shall match level on adjacent roadways subject to above restriction.

3.6.2.4.2 Area lighting. Illumination level for parking areas shall be 0.6 to 1.0 footcandle average maintained with 4:1 uniformity ratio, and for walkways shall be 0.1 to 0.6 footcandles, with 6:1 uniformity.

3.6.2.4.3 Security/protective lighting. All security/protective lighting systems shall be designed in accordance with FAA Order 1600.6B. Emergency power sources are required for this type system.

3.6.2.4.4 Special considerations. Exterior lighting units in the vicinity of airfields shall be aimed or shielded so that no direct or stray light is emitted above the horizontal to interfere with the nighttime visibility of control tower operators or to be confused with runway navigational lights by air traffic. Light sources should be compatible with adjacent areas.

3.6.2.4.5 Obstruction lights. Obstruction lights shall be provided as required in FAA AC 70/7460-1.

3.6.2.4.6 Circuit design. All new systems shall utilize underground distribution, except short extensions to existing systems shall match existing distribution type.

3.6.2.4.6.1 Multiple systems. Multiple systems shall be used for all new work, for extensions to existing multiple systems, and for extensive additions to existing series systems.

3.6.2.4.6.2 Series systems. Series systems shall be used only for short extensions to existing series systems where its use is more economical than multiple systems.

3.6.2.4.7 Lighting intensities. Lighting intensities shall be based on initial lamp/fixture output and lamp lumen depreciation. Luminaire dirt depreciation shall be assumed to be negligible.

3.6.3 Interior electrical systems. All interior electrical systems shall be in accordance with FAA-C-1217.

3.6.3.1 Power distribution.

3.6.3.1.1 Wiring. Unless otherwise specified, all conductors in conduit, 3/4 inch or larger, shall be concealed in walls, ceilings, or floor where practical. Conduit in unfinished spaces, such as mechanical and electrical rooms, may be run exposed.

3.6.3.1.2 Conductors. Conductors shall be sized in accordance with the NEC. Thermal withstand capabilities of conductors and conductor bracing shall be based on available fault level and duration at each point in the system.

3.6.3.1.3 Panelboards. All panelboards shall be sized to include at least twenty five (25) percent spare capacity. All busing shall be braced for available fault current.

3.6.3.1.4 Heat tapes. Heat tapes shall be provided for all water pipes where exposed to freezing conditions. Visual indicator for "ON" condition shall be provided.

3.6.3.1.5 Transformers.

3.6.3.1.5.1 Selection. Transformers shall be selected based on ambient conditions, basic impulse insulation level, power utilization requirements, and economic analysis. Flammable transformer liquids shall not be used indoors.

3.6.3.1.5.2 Insulation system. Transformer shall be capable of carrying continuously 115 percent of the nameplate volt-amperes without exceeding the insulation rating.

3.6.3.1.5.3 Sizing. Transformers shall be sized to include at least twenty five (25) percent spare capacity.

3.6.3.1.6 Distribution equipment.

3.6.3.1.6.1 Substations. Substations with a primary voltage of 15 kV or less may be installed indoors. Location and quantity of substations shall be based on the most economical balance between the cost of a secondary distribution system and the cost of transformers, switchgear, and primary distribution.

3.6.3.1.6.2 Switchboards. Deadfront distribution switchboards shall be the individually mounted and individually compartmented type. When used as service equipment, switchboards shall be labeled as service entrance equipment.

3.6.3.1.6.3 Power switchgear assemblies. When used as service equipment, power switchgear assemblies shall be labeled as service entrance equipment.

3.6.3.2 Wire communications and signal systems.

3.6.3.2.1 Telephone system. An empty conduit system shall be provided for the telephone system in administrative and office areas. Unless otherwise required, a cable tray system shall be provided for the telephone system in other areas. Requirements for the conduit or tray system shall be coordinated with the local telephone company and the designated approval authority for the facility.

3.6.3.2.2 Empty conduit. System design shall be coordinated with the designated approval authority for the equipment layout. Empty conduit systems shall be provided for the following:

a. Intercom systems;

b. Public address or paging systems;

c. Intrusion alarm systems.

3.6.3.2.3 Cable tray systems. Cable tray systems shall be provided for interconnection of electronic equipment, and for other equipment/systems as indicated above. Cable tray system design shall be coordinated with the designated approval authority for the equipment layout.

3.6.3.3 Lighting systems. Interior lighting design shall provide a comfortable level of lighting intensity on task areas, and sufficient ambient lighting to allow for ease of circulation through the space. Color rendition shall degrade neither space function nor safety.

3.6.3.3.1 Illumination levels. The IES Lighting Handbook shall be used as a guide; the illumination values indicated shall be used as upper limit values which shall not be exceeded. Lower lighting intensities shall be considered, shall be consistant with the nature and type of

occupancy and with energy conservation goals, and shall be as approved or directed by FAA. All calculations shall be in accordance with the IES Lighting Handbook, for average maintained illumination and uniformity. Lighting intensities shall be based on initial lamp/fixture output and lamp lumen depreciation. Low-brightness, non-glaring enclosures shall be used near CRTs, indicating panels, and in computer rooms.

3.6.3.3.2 Incandescent lighting fixtures. Use of incandescent lighting fixtures shall be avoided to the maximum extent practicable. Incandescent lighting fixtures may be utilized only in areas where intermittent use is anticipated, such as closets or small toilets, when shown to be cost effective by life cycle cost analysis.

3.6.3.3.3. Emergency lighting equipment.

3.6.3.3.3.1 Facilities without engine generator sets. Emergency lighting shall be provided by self-contained battery lights as follows:

a. Illumination of exits, corridors, and stairs;

b. Interior spaces housing critical electrical and mechanical equipment;

c. Critical areas having electronic equipment.

Unless otherwise specified, batteries shall be sized for 1-1/2 hours of operation after failure of normal power. Facilities having a four hour dc power system for electronic equipment, shall have battery lights sized for 5-1/2 hours of operation after failure of normal power.

3.6.3.3.3.2 Facilities with engine generator sets. The emergency lighting shall be as follows:

a. Battery lights in engine/generator rooms, electrical rooms, computer rooms, and control rooms, as applicable;

b. Space luminaries connected to the emergency power circuits in all occupied spaces, electrical/mechanical room, break room, and lavatory;

c. Exit corridors and vestibules shall have a sufficient number of the general building luminaries connected to the emergency system to provide emergency egress illumination.

3.6.3.3.3.3 Remote unmanned facilities. Unless otherwise directed, emergency lighting shall not be required at remote unmanned facilities.

3.6.3.3.4 Cleaning lights. Cleaning lights shall be provided in areas where low ambient lighting is required and shall be controlled by a key operated switch.

3.6.3.4 Motors and motor controllers.

3.6.3.4.1 Motors. All motors one-half horsepower and larger shall be three-phase. Motors less than one-half horsepower shall be single-phase.

3.6.3.4.2 Motor controllers. All motor controllers, except those provided as an integral part of equipment other than motor control centers, shall be the product of one manufacturer. All controllers for polyphase motors less than forty horsepower shall be the magnetic across-the-line type. All controllers for small motors, when required by a utility company and for motors forty horsepower and larger, shall be the reduced voltage type.

3.6.3.4.3 Motor control centers. Motor control centers shall be used whenever four or more motor controllers would otherwise be grouped in close proximity. Busing shall be designed in such a way that the motor control center can be expanded from both ends. Adequate space shall be provided around equipment to allow for expansion without impinging on NEC minimum required working space. Terminal blocks shall be the plug-in type so that controllers can be removed without disconnecting individual control wiring. Controllers shall be individually mounted and compartmented.

3.6.4 Standby power systems. Standby power systems shall be in accordance with FAA Orders 6030.20 and 6950.2. Installation of standby engine generator systems shall be in accordance with FAA-C-1244. Where standby engine generator systems are provided, emergency lighting systems, fire alarm systems (usually on battery back-up power), elevators, (if applicable) and certain HVAC equipment shall be connectable to the standby power system.

3.6.4.1 DC power system. All dc power systems shall be in accordance with FAA Orders 6980.24 and 6980.26. Certain FAA facilities not equipped with a standby engine/generator set require a nominal 12 or 24 volt dc electrical power supply. The dc power system shall consist of the following:

a. Panel, sized as required;

b. Unless otherwise stated, battery system capable of sustaining operation of the equipment for a minimum period of eight hours after loss of normal power;

c. System voltage at the equipment shall remain within the nominal voltage ranges defined in FAA-G-2100, whether being energized by normal power, from battery alone, or during transition or charging periods;

d. Rectifier shall have sufficient capacity to supply dc power to the equipment and recharge the battery within 12 hours following a four-hour operation of the battery. Maximum dc output ripple to equipment shall not exceed 100 millivolts peak when energized by normal power and without battery connected. The ac and dc rectifier shall be solid-state and acceptable to the telephone and microwave industries.

3.6.5 Grounding, bonding, and shielding systems. Grounding, bonding, and shielding systems shall be provided in accordance with FAA-STD-019. Raised floor systems shall be grounded and bonded.

3.6.6 Lightning and transient protection systems. Lightning and transient protection systems shall be in accordance with FAA-STD-019.

3.6.7 Electromagnetic interference (EMI). EMI is a major concern for NAS facilities. EMI shall be minimized and all designs shall be in accordance with FAA-STD-019.

3.6.8 Seismic requirements for support systems. Analysis of seismic loading shall be provided for all support systems, including but not limited to lighting fixtures supports and pads for pad-mounted equipment. Seismic design shall be in accordance with UBC and AFM 88-3, Chapter 10 of Chapter 13. All national standard designs shall be designed to a minimum of UBC Zone III seismic requirements. Seismic requirements for site adapted designs shall be in accordance with UBC.

3.6.9 Cathodic protection. Cathodic protection shall be evaluated for the following:

a. Underground metallic pipes, structures and foundations;

b. Interior of elevated steel tanks;

c. Exterior and interior surfaces of buried, or partially buried, steel tanks and large metallic pipes;

d. Lead-covered cables;

e. Submersible-type equipment in manholes and underground vaults subject to frequent immersion;

f. Metallic structures submerged in water.

Cathodic protection shall be of the galvanic or applied potential type. Life-cycle cost analysis shall be used to determine the economic feasibility of cathodic protection.

3.6.10 Battery systems. Battery systems shall be in accordance with FAA Orders 6980.24 and 6980.26.

3.6.11 Alternative or renewable power sources. Alternative or renewable power sources shall be considered for remote facilities, and other facilities where shown economically feasible. Alternate and renewable power sources shall be in accordance with FAA Order 6980.26.

3.7 Life safety and fire protection. Buildings and structures shall be designed to avoid undue danger to the lives and safety of the occupants and to the equipment and facilities.

3.7.1 Standards. Except as provided herein, life safety and fire protection requirements shall be in accordance with FAA Order 3900.19 and shall comply with recognized national, standard, or to uniform codes and standards applicable to the specific facility location. FAA national standard designs shall comply with the Uniform Building Code, Uniform Building Code Standards and Uniform Fire Code. Recognized codes and standards for site adapted designs include the following:

a. The BOCA Basic/National Building Code

b. The BOCA Basic/National Fire Prevention Code

c. Fire Protection Handbook

d. National Fire Codes

e. National Electrical Code (NEC)

f. Standard Building Code

g. Standard Mechanical Code

h. Uniform Building Code (UBC)

i. Uniform Fire Code

3.7.1.1 Relevant factors. Factors relevant to life safety and fire protection shall include, but not be limited to the following:

a. Aisles and walkways;

b. Floors;

c. Stairs;

d. Doors;

e. Means of egress;

f. Warning signs and barricades;

g. Hazardous contents;

h. Ramps;

i. Hazardous areas;

j. Fire walls, partitions, and steps;

k. Emergency lighting;

l. Fire and smoke detection and alarm;

m. Fire extinguishing systems including sprinklers, hose and stand pipe, fire hydrants, halon and carbon dioxide systems;

n. Location and number of portable fire extinguishers;

o. Mechanical smoke evacuation means.

3.7.2 Local code considerations. Consideration shall be given to fire regulations promulgated by local authorities. Where designs or construction conflict with the requirements of local fire authorities and the problems cannot be resolved without detriment to the FAA, such disagreement shall be immediately reported for resolution.

3.7.3 Life safety and fire protection specific requirements for ATCTs, ARTCCs, and similar facilities. Life safety and fire protection specific requirements for ATCTs, ARTCCs and similar facilities shall be in accordance with FAA Order 3900.19. Additional requirements for ATCTs are provided in FAA Order 6480.7.

3.7.3.1 Computer rooms and electronic equipment areas. Computer rooms and electronic equipment areas shall be constructed of fire resistant material to preclude the need for automatic sprinklers. Fire extinguishing systems shall be provided in accordance with FAA Order 3900.19.

3.7.3.2 Additional fire detection and alarm system requirements. Unless otherwise specified, in addition to fire detection and alarm system requirements cited in FAA Order 3900.19, the detection and alarm system for areas in which halon fire extinguishing equipment is installed shall also comply with the following requirements.

a. The system shall allow for safe, efficient, and complete evacuation of all personnel from the affected area prior to automatic discharge of the halon extinguishing agent. The maximum delay between alarm and discharge shall be 1 minute, except as provided below.

b. Manually activated discharge of the agent shall be immediate and uninterruptible. The agent discharge manual pull stations shall be equipped with covers or other devices which prevent accidental discharge of the agent. Visible indication of an activated pull station shall be provided and shall remain noticeable until deliberately reset by authorized personnel. A key switch station shall allow for manual override of the automatic discharge timing sequence activated by cross-zoned detector circuits. The key switch stations shall be a maintained-type consisting of clearly marked abort, automatic and agent discharge functions. The abort function shall suspend the automatic sequence and prevent automatic agent discharge until the key switch station is returned to the automatic or discharge position.

c. Recirculating air handling units (AHUs) within the Halon protected area shall continue to operate during agent discharge to facilitate the distribution of the agent.

d. Discharge of the Halon shall remote signals to the systems monitoring and maintenance console (SMMC), facility fire alarm panel, and shall illuminate an indicator light on the Halon supervisory control panel.

3.7.4 Portable fire extinguishers. Portable fire extinguishers shall be conspicuously located where they will be readily accessible and immediately available in the event of fire. They shall be located along the normal path of travel and at doors. The minimum quantity, size and type of fire extinguishers required at FAA facilities shall be as provided in Appendix II. Fire extinguisher protection for rooms or areas not listed can also be determined from Appendix II by using the associated notes.

3.7.5 Additional design criteria. Additional life safety and fire protection design criteria and not covered above shall be in accordance with the Fire Protection Handbook.

3.8 Quality assurance requirements. All design of new physical facilities and modifications to existing physical facilities shall be subject to the scrutiny of the Joint Acceptance Inspection.

3.8.1 Internal design review. The A/E shall continually monitor and fully coordinate all designs, site inspections, site investigations, reviews, and document preparation efforts. Preparation of specialized portions of designs shall be accomplished, or supervised by, and certified by experienced persons having state registration in the applicable field. Original tracings of all drawings, the first page of all specifications, estimates, and similar deliverables shall be certified and signed by the A/E. The signature shall appear under the A/E's printed name and over the affixed replica of the professional seal or registration certificate number. Unless otherwise waived by FAA, each

deliverable item requiring signature shall bear the signature of the registered professional person of the respective disciplines: civil, structural, architectural, mechanical, electrical, fire protection, etc. In addition all structural calculation sheets, divisions, and other structural documents shall have the signature and seal of a professional structural engineer. The requirement for signatures by registered professional structural engineers will not be waived.

3.8.1.1 Seismic Zone IV. All structural documents prepared for Seismic Zone IV shall be sealed by a registered structural engineer from a state in which the facility will be located.

3.8.1.2 Unique design techniques. The A/E shall conduct such tests as are necessary to ensure validity of design techniques which have not been proven by previous application. The A/E shall prepare and submit reports on findings.

4. QUALITY ASSURANCE PROVISIONS

This section is not applicable to this standard.

5. PREPARATION FOR DELIVERY

This section is not applicable to this standard.

6. NOTES

6.1 Additional data required. Attention of procurement request initiators is invited to the items listed below which should be covered in the system/subsystem or engineering services specification or contract schedule.

6.1.1 General requirements. Specifications should not categorically impose all requirements of this standard. Impose only those requirements which are applicable to the specific project. Identify FAA system/subsystem or equipment to be served by the physical facility, the number and type of operating positions, training, administrative, related maintenance and storage activities, protection and security requirements. Note exceptional cases and provide written authorization where compliance to local codes preceeds compliance to nationally recognized codes (3.1).

6.1.2 Environmental impact. Identify those physical facilities for which previous environmental impact statements (EISs), environmental assessments, or categorical exclusions exempt the new facility from further assessment and reporting (3.1.2.1).

6.1.3 Construction scheduling. Identify those physical facilities for which critical path method (CPM) network schedule analysis is required to be prepared during design phase. Specify performance period and minimum number of activities to be considered and shown. Specify additional safety requirement to be imposed for design and construction of facilities or airports (3.1.4).

6.1.4 Construction safety at airports. Identify the airport operator or user who is to review and approve the safety plan. Specify necessary deviations from safety provisions identified in the Advisory Circular (3.1.4.4).

6.1.5 Engineering cost estimate. Provide approved cost estimating forms or approve cost estimating forms provided by the cost estimator (3.1.7.1).

6.1.6 Design implementation cost control. Identify project requiring cost control reporting (3.1.7.2).

6.1.7 Economic analysis. Identify major physical facility systems and items of equipment for which economic analysis is required. Identify economic life for the facility if different or not provided by this standard (3.1.9).

6.1.8 Provisions for the physically handicapped. Note any exceptions or exemptions to the requirements for provisions for the physically handicapped. Identify specific work areas and job tasks anticipated or known for the handicapped at the facility (3.1.10).

6.1.9 Design data summary handbook. Specify when the handbook is not required (3.1.13).

6.1.10 Mechanical and electrical system handbook. Specify when the handbook is not required (3.1.14).

6.1.11 Mechanical/electrical systems instruction book. Identify those physical facilities for which mechanical/electrical systems instruction book is required. This document provides comprehensive physical and functional system descriptions, design intent, operation and maintenance data and should only be required for those major or complex facilities for which the degree of detail implicit with this requirement can be justified (3.1.15).

6.1.12 Provisions for remote maintenance and monitoring system. Indicate RMMS requirements in terms of systems and equipment to be monitored or controlled. Indicate detector types, interface points and other pertinent data (3.1.16).

6.1.13 Soils reports. Specify deviations from standard including whether or not report is required (3.2.2.3).

6.1.14 Vehicle parking. Identify the number and type (employee, visitor, handicap, etc.) of parking spaces required for a specific facility. Designate areas requiring vehicle heater receptacles (3.2.5.4).

6.1.15 Fencing. Identify those sites for which fencing is a requirement, identify electromagnetic interference (EMI) considerations; type of gates; locks and other site peculiar requirements (3.2.6).

6.1.16 Site planning. Specify site planning requirements including planned location of facilities (3.3.1.1).

6.1.17 Future expansion. Identify future planning requirements (3.3.1.3).

6.1.18 Organization of interior spaces. Identify facility population, administrative and extraordinary technical requirements (3.3.2).

6.1.19 Construction systems. Identify applicable standard drawings and specifications for specific facility types (3.3.4.1).

6.1.20 Mobile facilities and systems. Specify additional requirements, including siting requirements, for mobile facilities and systems (3.3.4.6).

6.1.21 Electrostatic discharge control. Identify areas within physical facility where electrostatic discharge control is required (3.3.5).

6.1.22 Building security systems. Identify sensitive national security data, communications, and information areas within the physical facility. Provide requirements for system surveillance by the RMMS (3.3.8).

6.1.23 Essential basic functional relationships. Specify basic functional relationships essential to flight safety and mission integrity which shall not be compromised for nominal cost savings (3.4.4.3).

6.1.24 Qualifing criteria for providing temperature and humidity control equipment and systems. Submit updated list to A/E with revised categorization of facilities (3.5.2.1.1).

6.1.25 Interior environment. Identify extraordinary interior environmental conditions. Specify minimum and maximum temperature and humidity alarm set points where applicable. Identify electronic equipment heat contribution to room in which it is located (3.5.2.2.1).

6.1.26 Human occupancy factors. Specify human occupancy factors such as number of people, frequency and duration of occupancy, type of tasks indicating energy expediture and other pertinent data (3.5.2.2.1.2).

6.1.27 Redundant systems. Identify redundance requirements to support facility reliability, availability and maintainability requirements (3.5.2.4.4).

6.1.28 Toilet systems. Provide review and approval of designs of exterior toilet systems on a site-by-site basis (3.5.3.1).

6.1.29 Cable loop system and capability. Identify planned or existing facilities with cable loop system. Specify requirements to be imposed for design and construction compatibility to the cable loop system (3.6.2.2.4).

6.1.30 Lighting systems. Identify areas of varying activity and periods of activity which would affect lighting controls (3.6.2.4).

6.1.31 Wire communication and signal systems. Identify empty raceway requirements for wire communication and signal systems to be provided by others (3.6.3.2).

6.1.32 Government furnished equipment. Identify equipment to be furnished by the government and installed under physical facility construction contract.

6.1.33 Provisions for equipment furnished and installed under other contracts. Identify voltage, power and space requirements for electronic and data processing systems when furnished under other contracts.

6.1.34 Construction support activities. Indicate requirements for construction support activities including, but not limited to construction inspections and supervision, shop drawing review, and as-built preparation.

6.1.35 Internal design review. Indicate waived requirements and specify additional requirements for internal design review of documents and document preparation.

6.2 Acronyms, abbreviations and definitions.

6.2.1 Acronyms and abbreviations. The following are definitions of acronyms and abbreviations used in this standard.

A/E	Architect/Engineer
AAMA	Architectural Aluminum Manufacturer's Association
AASHTO	American Association of State Highway and Transportation Officials
ac	Alternating Current
ACGIH	American Conference of Governmental Industrial Hygienists
AFM	Air Force Manual
AFSS	Automated Flight Service Station
AHU	Air Handling Unit
AISC	American Institute of Steel Construction
ANSI	American National Standards Institute
ARSR	Air Route Surveillance Radar
ARTCC	Air Route Traffic Control Center
ARTS	Automated Radar Terminal System
ASDE	Airport Surface Detection Equipment
ASHRAE	American Society of Heating, Refrigerating, and Air Conditioning Engineers
ASR	Airport Surveillance Radar
ATC	Air Traffic Control
ATCT	Airport Traffic Control Tower
AWG	American Wire Gauge
AWS	American Welding Society
BOCA	Building Officials and Code Administration
CCMS	Central Control Monitoring System
CO_2	Carbon Dioxide
CPM	Critical Path Method
CRT	Cathode Ray Tube
DB	Dry Bulb
dc	Direct Current
EMI	Electromagnetic Interference
EPA	Environmental Protection Agency
ESD	Electrostatic Discharge
F	Fahrenheit
FAA	Federal Aviation Administration
FSS	Flight Service Stations
gal	Gallon

HVAC	Heating, Ventilating, and Air Conditioning
IAPMO	International Association of Plumbing and Mechanical Officials
IEEE	Institute of Electrical and Electronics Engineers
IES	Illuminating Engineering Society
kV	Kilovolt
lb	Pound
max	Maximum
min	Minimum
NAS	National Airspace System
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
NFC	National Fire Code
NFPA	National Fire Protection Association
OSHA	Occupational Safety and Health Administration
PCB	Polychorinated Biphenyls
PCS	Power Conditioning System
psig	Pounds per Square Inch, Gauge
RCAG	Remote Communication Air/Ground
RH	Relative Humidity
RMMS	Remote Maintenance Monitoring System
SBCCI	Southern Building Code Congress International
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association
SMMC	System Monitoring and Maintenance Console
sq ft	Square Feet
TRACON	Terminal Radar Approach Control Facility
Temp	Temperature
UBC	Uniform Building Code
UBCS	Uniform Building Code Standards
UL	Underwriters Laboratories
UMC	Uniform Mechanical Code
UPC	Uniform Plumbing Code
UPS	Uninterruptible Power Source
VOR	VHF Omnidirectional Range
VORTAC	VOR Collocated with TACAN
WB	Wet Bulb

6.2.2 Definitions.

6.2.2.1 Climatic zone. A geographic area with a defined range of summer and winter conditions.

6.2.2.2 Component. An element or subelement of a system or equipment which can be replaced and the failure of which would cause the failure of the system or equipment. Example: fan belt of a belt-driven fan.

6.2.2.3 Critical spaces. Spaces that provide the physical environment for equipment whose function or service, if lost, would prevent the NAS from exercising safe separation and control of aircraft.

6.2.2.4 Economic life. That life of a physical facility at the end of which the facility has no redeeming value and can no longer be used.

6.2.2.5 Essential. Functions or services that, if lost, would reduce the capability of the NAS to exercise safe separation and control of aircraft.

6.2.2.6 Mission equipment. Equipment that is essential or critical to the utility of the NAS to exercise safe separation and control over aircraft.

6.2.2.7 Physical facility. The total plant required for a subelement or subsystem to function. The physical facility will house, support or protect the subelement or subsystem at a particular geographic location. The physical facility will have various physical characteristics in accordance with the function of the subelement or subsystem. The physical facility can be of the following types depending on the required function:

a. Building - Consists of walls, floor(s) and a roof either single story or multi-story constructed of various material; usually fixed in location and housing personnel and equipment. The building may include air conditioning, power, etc., if required for the particular application.

b. Structure - Composed of interrelated parts which together form a structural entity, usually fixed in location containing equipment and which may be manned or unmanned. The structure may include air conditioning, power, etc., if required for the particular application.

c. Enclosure - Interrelated parts which surround or shut in equipment, fixed or movable, usually unmanned. The enclosure may include air conditioning, power, etc, if required for the particular application.

d. Assembly - Composed of interrelated parts which together form a functional entity, fixed or mobile, containing equipment.

6.2.2.8 Requirement. A specified capability which must be provided by the system, subsystem, end item, contractor, etc. Type of requirements include operational, functional, performance, interface, facility, and verification requirements.

6.2.2.9 Support equipment. Equipment that provides electrical or environmental conditioning for mission equipment. HVAC and UPS/PCS are examples of support equipment.

6.2.2.10 Verification matrix. A formalized confirmation checklist of major design items, considerations, and criteria, etc. displayed in a rectangular array.

Appendix I

10. Physical Facility Economic Life

Facility Acronym	Facility Name	Economic Life (Years)
ACF	Area Control Facility	25
AFSS	Automated Flight Service Station	15
ARSR	Air Route Surveillance, Radar Transmitter/ Receiver Building	15
ARTCC	Air Route Traffic Control Center	25
ARTS	Automated Radar Terminal System Building	15
ASDE	Airport Surface Detection Equipment Transmitter/ Receiver Building	15
ASR	Airport Surveillance Radar Transmitter/Receiver Building	15
ATCCC	Air Traffic Control Command Center	20
ATCT	Airport Traffic Control Tower	20
FSS	Flight Service Station	20
IFSS	International Flight Service Station	20
RCAG	Remote Communications Air/Ground Facility	20
RTR-ATCT	Remote Transmitter/Receiver Building at an ATCT	20
RTR-FSS	Remote Transmitter/Receiver Building at an FSS	15
TRACON	Terminal Radar Approach Control Facility	15
VOR/VORTAC	VOR or VOR collocated with TACAN	20

Appendix II

20. Fire Extinguisher Distribution

20.1 Minimum Quantity and Type of Extinguisher NOTE 1

Room Type	Water Antifreeze and Loaded Stream	Carbon Dioxide CO_2	Dry Chemical	Halon 1301
AIR ROUTE TRAFFIC CONTROL CENTER	1 - 2-1/2 gal/3000 sq ft or portion		NOTE 2	
Control Room		1 - 15 lb/1600 sq ft portion		NOTE 6
Electronic Equipment Wing		NOTE 3		
Computer Room		NOTE 3		
Electric Service Room		1 - 15 lb/1600 sq ft or portion		NOTE 6
Air Conditioning Equipment Room		2- 15 lb		NOTE 6
Attic Space		1 - 15 lb/1600 sq ft or portion		NOTE 6
Boiler Room		2 - 15 lb		
Garage		1 - 15 lb	2 - 10 lb NOTE 4	NOTE 6 NOTE 6
General Storage		1 - 15 lb		NOTE 6
Engine Generator Room		2 - 15 lb		NOTE 6
Kitchen		1 - 15 lb	2 - 5 lb multipurpose NOTE 5	NOTE 6
Office space	1 - 2-1/2 gal/3000 sq ft or portion			

Room Type	Water Antifreeze and Loaded Stream	Carbon Dioxide CO_2	Dry Chemical	Halon 1301
Security Building		1 - 15 lb		NOTE 6
Telco Room		2 - 15 lb		NOTE 6
PCS Equipment Room		3 - 15 lb		NOTE 6
PCS Battery Room		2 - 15 lb		NOTE 6
OTHER FAA FACILITIES				
Boiler Room		1 - 15 lb		NOTE 6
Computer Room		NOTE 3		
Electric Service Room		1 - 15 lb/ 6000 sq ft or portion		NOTE 6
Electric, Electronic Storage		1 - 15 lb/ 6000 sq ft or portion		NOTE 6
Electronic Equipment Room		1 - 15 lb/ 6000 sq ft or portion		NOTE 6
Engine-Generator Room		1 - 15 lb		
Furnace Room		1 - 15 lb		
Garage and Gasoline Station		1 - 15 lb	2 - 10 lb NOTE 4	
General Storage		1 - 15 lb		
Kitchen		1 - 15 lb	2 - 15 lb multipurpose NOTE 5	
Mechanical Equipment Room		1 - 15 lb/ 1600 sq ft or portion		

Room Type	Water Antifreeze and Loaded Stream	Carbon Dioxide CO_2	Dry Chemical	Halon 1301
Office Space	1 - 2-1/2 gal/ 3000 sq ft or portion			
Living Quarter Kitchen			1 - 2-1/2 lb multipurpose	
Telco Equipment Room		2 - 15 lb		
Tower Cab		1 - 15 lb/1600 sq ft or portion		
Tracon Room		1 - 15 lb/1600 sq ft or portion		
Shop (maint.)		1 - 15 lb		
Shop, Flammable Metal		1 - 15 lb	Class D 5 lbs/lb flammable metal	
PCS Equipment Room		3 - 15 lb		NOTE 6
PCS Battery Room		2 - 15 lb		

20.1.1 Notes.

1. An extinguisher shall be available within 50 feet from any point in a room. This may increase the number of extinguishers over the quantity required in the above table.

2. A 10-lb multipurpose dry chemical extinguisher may be used in lieu of a water extinguisher except in electrical/electronic equipment areas. Neither dry chemical extinguishers nor water extinguishers shall be used on electric/ electronic equipment. Antifreeze extinguishers shall be used in areas subject to freezing temperatures to -40°F. Below -40°F, extinguishers shall be placed in enclosures to maintain the temperature within specified limits.

3. Stationary extinguisher units consisting of two CO_2 cylinders having a minimum capacity of 50 lb each shall be installed. Each stationary unit shall be manifolded to a hose reel, holding 100 feet of 1/2 inch CO_2 hose and a horn-shaped nozzle, and located so that a least two fire hoses can reach any point in the electronic equipment room. Additional 15-lb CO_2 extinguishers will be added to be accessible within not more than 50 feet from any point within the room.

4. Extinguishers shall be installed in suitable enclosures outside of each garage and gasoline dispensing station.

5. One 5-lb multipurpose dry chemical extinguisher shall be installed adjacent to the kitchen.

6. Halon 1301 extinguishers may be used instead of CO_2 extinguishers. One 4-lb Halon extinguisher is equivalent to a 15-lb CO_2 extinguisher. In electric, electronic equipment and telco rooms, Halon 1301 extinguishers shall be preferred over CO_2 extinguishers.

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